

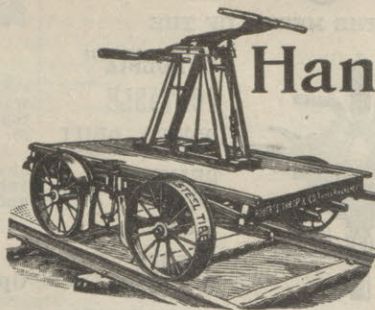
IMPROVED ENGINE SPRINGS

EVERY SPRING
GUARANTEEDSEND FOR
ILLUSTRATED CIRCULARCharles Scott Spring Co.,
* PHILADELPHIA *

1421 Monadnock Block, Chicago, Ill.

1417 Union Trust Bldg., St. Louis

"CYRUS ROBERTS"

Hand Car Specialties
WARRANTEDEASY RUNNING,
LIGHT IN WEIGHT,
PERFECT WHEEL,
Roberts, Throp & Co.
THREE RIVERS, MICH.

New Steel Freight Cars.

WRITE FOR PARTICULARS TO
PENNOCK BROS., Manufacturers of Railway Freight Cars, MINERVA, OHIO

A. W. SOPER, President.

ROBT ANDREWS, Vice-President.

R. M. DIXON, Engineer.

C. H. HOWARD, Secretary.

W. R. THOMAS, Treas.

The Safety

THE • HEATING • SYSTEMS.

BY HOT WATER CIRCULATION AND DIRECT STEAM WITH
REGULATING DEVICES.
RELIABLE AND UNIFORM HEAT.
ECONOMICAL AND RAPID CIRCULATION.
GIBBS' AUTOMATIC COUPLER OF WESTINGHOUSE TYPE,
ABSOLUTELY STEAM TIGHT.

Car Heating and Lighting Co.,

160 BROADWAY, NEW YORK.

THE • LIGHTING • SYSTEM.

THE CELEBRATED PINTSCH COMPRESSED OIL GAS METHOD.
IN USE ON OVER 55,000 CARS IN EUROPE AND AMERICA.
THE BEST, MOST ECONOMICAL AND ONLY SAFE LIGHT FOR RAILROAD PURPOSES.
IN BRILLIANCY AND CLEANLINESS UNSURPASSED.
THIS SYSTEM HAS BEEN ADOPTED BY THE U. S. LIGHT-HOUSE BOARD FOR LIGHTING BUOYS.FOLIO
TFI
R4

This is a PARTIAL List of what we Build:

Engine Lathes.
Shafting Lathes.
Heavy Forge Lathes.
Driving-wheel Lathes.
Lathes for turning steel-tired car-wheels.
Lathes for turning printing-press cylinders.
Single Axle-lathes.
Double Axle-lathes.
Planing Machines for general work.
Planing Machines for frogs and split-switches.
Planing Machines for connecting-rods.
Plate-planing Machines.
Double Plate-planing Machines.
Shaping Machines.
Slotting Machines.
Slotting Machines for heavy forge work.
Slotting Machines for locomotive-frames.
Screw Machines.
Vertical Drilling Machines.
Radial Drilling Machines.
Arch-bar Drilling Machines.
Multiple Drilling Machines for special purposes.
Multiple Drilling and Tapping Machines.
Car-wheel Drilling Machines.
Horizontal Boring and Drilling Machines.
Horizontal Boring, Drilling and Milling Machines.
Pulley boring Machines.

Vertical Turret-boring and Turning Machines.
Chord-boring Machines.
Cylinder-boring Machines.
Cylinder and Valve-port Boring Machines for Corliss Cylinders.
Double Boring Machines for duplex pumps.
Car-wheel Boring Machines.
Boring and Turning Mills.
Boring and Turning Mills for steel tires.
Boring and Turning Mills with extensible housings.
Hydrostatic Presses for locomotive-drivers and car-wheels.
Hydrostatic Forcing Presses for shafts and similar work.
Quartering and Crank-pin Machines for locomotive-drivers.
Cutting-off Machines.
Double Cutting-off and Centering Machines.
Plate-bending Rolls for sheet, tank and boiler work.
Plate-bending Rolls for ship plates.
Vertical Bending Rolls for armor plates.
Plate-straightening Machines.
Shaft-straightening Machines.
Pipe Cutting-off Lathes.
Retaining-ring Bending Rolls.
Car-wheel Plate Lathes, Etc., Etc., Etc., Etc.

BRANCHES:
NEW YORK, PITTSBURGH,
PHILADELPHIA,
CHICAGO, BOSTON.

ENSIGN MANFG. CO.,

Manufacturers of CARS,
For Every Kind of Freight Service.
CAR WHEELS,
Cast in Contracting Chills.

Sole Manufacturers in the United States of RUSSELL SNOW PLOWS.

F. E. CANDA, Pres. C. J. CANDA, Vice Pres. J. W. SAVIN, Gen'l Agent.
11 Pine st., NEW YORK. E. ENSIGN, Sec'y and Treas. HUNTINGTON, WEST VIRGINIA.

CHARLES J. CANDA, Pres.

F. MORA CANDA, Treas.

FREDERICK HUDSON, Sec'y.

FERDINAND E. CANDA,

JOHN W. SAVIN,

ELY ENSIGN, Vice Presidents.

CANDA MANFG. CO.,

Manufacturers of CARS

For Freight and Passenger Service and
CHILLED CAR WHEELS of the Highest Quality

Offices: 11 Pine Street, NEW YORK CITY.

Works: Carteret, N. J.

Passenger Cars

Of the finest finish, as well as every description of CAR WORK furnished at short notice and at reasonable prices, by the

HARLAN & HOLLINGSWORTH CO.,
WILMINGTON, DEL.DELAWARE CAR WORKS
JACKSON & SHARPE COMPANY,

MANUFACTURERS OF

Passenger, Sleeping, City, Baggage and Freight Cars,
WILMINGTON, DEL.

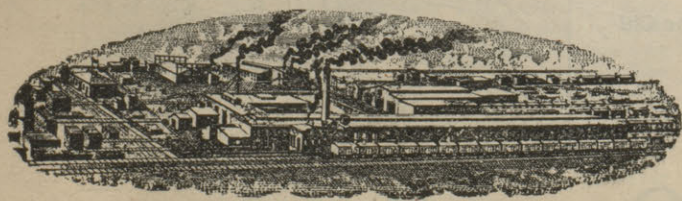
Cable address "Jackson". Special attention given to Sectional Work for exportation and narrow-gauge cars.

The Only MEDAL and all the PREMIUMS on

Railroad Frogs, Crossings, Switches and Switch-Stands at the Columbian Exposition were awarded

THE CARLISLE MFG. CO., CARLISLE, PA.

Write for Lithographs and Prices. FREIGHT CARS of every kind and VERTICAL ENGINES.

D. O. SETTLEMIRE, President.
GEO. W. EVANS, Vice President.W. C. ARTHURS, Secy. and Treas.
FRANK SNYDER, Supt.

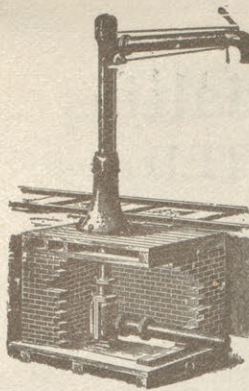
MT. VERNON CAR MANUFACTURING CO.,

—MANUFACTURERS OF—

Freight Cars of Every Description, Caboose and Refrigerator Cars, Car Wheels, Car Castings and
General Foundry Work. CAPACITY: 15 Cars, and 200 Car Wheels.

MT. VERNON, ILL.

**Pumps,
Boilers.**



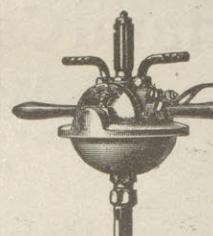
Water Stations
Complete.

M. M. MOORE,
225 Dearborn St.,
CHICAGO, ILL.

Moore's Balanced Railway
Water Column.

Investigate

THE MERITS OF THE



"PHOENIX"
PORTABLE
POWER DRILL,
REAMER
and
TAPPER

Operated by Steam or Air. Weight 40 Lbs.
In Use by Many Leading Industries.
Correspondence Solicited.

C. H. HAESELER & CO.,
1025 Hamilton St. Philadelphia, Pa.

**THE ASHTON
Muffler Safety Valve**



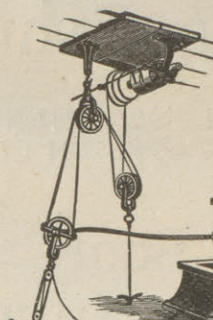
The only one with outside top regulation for the pop. Always available. Saves valuable time and expense.

Our muffler patents control the top outside pop regulating principle, which gives increased efficiency and durability.

— ALSO —

Open Pop Safety Valves and
Improved Steam Gages.

The Ashton Valve Co., 271 Franklin Street,
Boston, Mass.

STOW FLEXIBLE SHAFT.


Invented and
Manufactured by
the
**Stow
Mfg. Co.**
Binghamton,
N. Y.
Established 1875.
For Tapping
and Reaming
stay bolt holes
in
BOILERS.

PORTABLE DRILLING.

IRA DIMOCK, Pres. ESTABLISHED 1867. G. H. SERGEANT, Treas.

NORTHAMPTON EMERY WHEEL CO.

MANUFACTURERS OF

Premium Solid Emery

AND

Corundum Wheels,

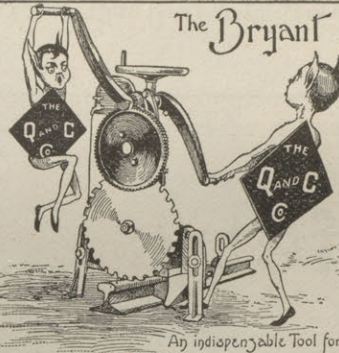
AND ALL KINES OF
EMERY WHEEL MACHINERY.

LEEDS, MASS.

WESTERN BRANCH
20 South Canal St., CHICAGO, ILL.



The Bryant Metal Sawing
Machine



Send for Catalogue.

Q and C Company
Chicago

Valuable in Cutting Off Rail Ends!
Making Cropping & Switch layout
MACHINES FOR ALL SIZES
Beams, Channels, etc.

An indispensable Tool for Train-men.
Makes Angle Cuts.

LOCOMOTIVE FIRE KINDLER

THE THURMAN FUEL OIL BURNER CO., General Offices, 31 & 32 Cordova Bldg.
INDIANAPOLIS, IND.

Designers, Contractors and Engineers for Complete Fuel Oil Equipment.

Branches: { 1401 Monadnock Block, Chicago
21-23 Fremont St., San Francisco, Cal.

OUR SYSTEM IS ECONOMICAL AND RELIABLE.
CHEAPER THAN COAL OR WOOD.
WE WILL GUARANTEE BETTER RESULTS THAN ANY OTHER MAKE.

Estimates furnished on application. Write for Catalogue. Should you desire a special Burner for special work, write us and we will design a Burner to meet the requirements. **SATISFACTION GUARANTEED.**

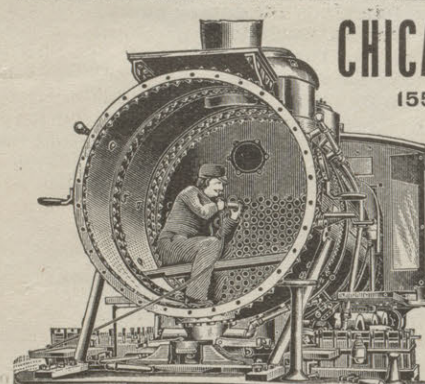
Acknowledged the Best for Locomotives and all Boilers, Furnaces, Ovens, Forges, Dryers, &c.

BURNERS FOR EVERY BRANCH OF INDUSTRY WHERE HEAT FOR ANY PURPOSE IS USED

CHICAGO PNEUMATIC TOOL CO.
1553 Monadnock Block, CHICAGO.

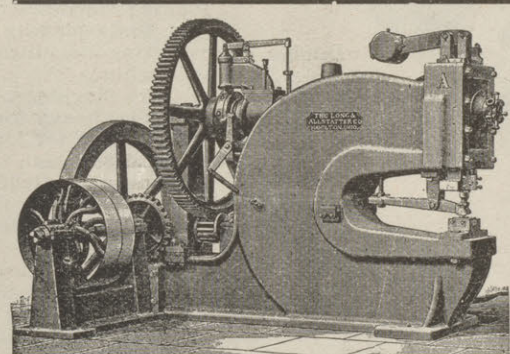
MANUFACTURERS OF

PNEUMATIC TOOLS.



Especially adapted for Railway Shops in caulking boilers, beading flues, cutting out fire-box patches, cutting off rivets and stay-bolts, heading rivets, chipping iron and steel castings, and cutting key slots, driving nails and spikes on car work. Will bead two locomotive flues per minute. All tools sent on ten day's trial, subject to approval and guaranteed for one year against repairs.

Long & Allstatter Co.
HAMILTON, O.



DOUBLE, SINGLE, HORIZONTAL,
BOILER, SPACING GATE, MULTI-
PLE, BELT AND STEAM DRIVEN
**PUNCHES
AND
SHEARS.**

Send for new Catalogue.
OVER 300 SIZES.

Heavy Single Machine—Special Gearing.

**FALLS HOLLOW MANUFACTURERS OF
SAFETY STAYBOLT IRON.**

STAYBOLT CO.

CUYAHOGA FALLS, O.

Potter & Hollis Foundry Co.,
**HIGH GRADE
STEEL CASTINGS.**
LIGHT CASTINGS FROM 1 to 100 POUNDS A SPECIALTY.

Office, 525 Rookery, - - - - - CHICAGO.

Balance Slide Valve



SIMPLEST, CHEAPEST, most DURABLE.

San Francisco, Cal. THE AMERICAN BALANCE SLIDE VALVE CO. Jersey Shore, Penn.

L. MANASSE,
88 Madison St., CHICAGO. Manufacturer and Dealer in

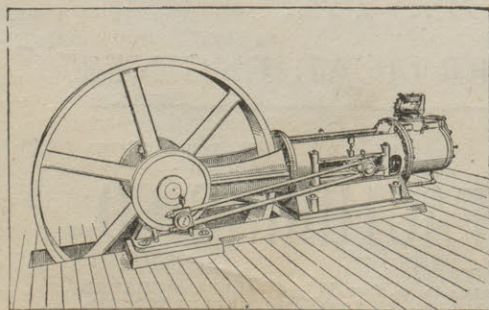
SURVEYING AND ENGINEERING INSTRUMENTS.

DRAFTING MATERIAL OF ALL KINDS.

Complete Catalogue Sent Free.



Work of Compressed Air in and about Chicago, by the Rand Drill Co. Machinery.

**ROCK DRILLS.**

1328 Monadnock Block, CHICAGO, ILL.

3,600,000 cubic feet of air furnished to Machine, Boiler and Railroad Shops per day.

15,000,000 gallons of water pumped from deep wells daily.

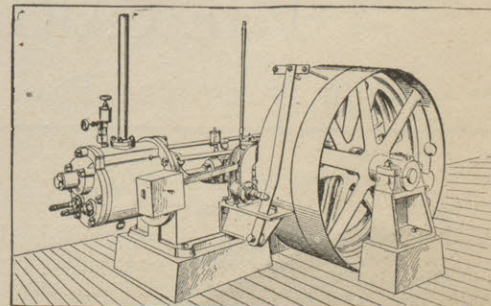
Over 9,000,000 cubic yards of rock excavated from the Chicago Drainage Canal in three years.

Over six miles of Intake Tunnel being driven.

RAND DRILL CO.

American

Bldg., 100 Broadway, NEW YORK CITY.

**AIR COMPRESSORS.**

THE RAILWAY REVIEW

XXXVI.

FEBRUARY 1, 1896.

No. 5.

RAILWAY REFORMS IN DENMARK.—The Danish government is proposing reforms which, if passed by the Folkething, will make passenger tickets in Jutland cheaper than in any other country; their freight rates are already the lowest known. The bill dwells on the absurdity or granting reduced fares for return tickets. There might have been some sense in cheaper return tickets in the early days, when return tickets were available for one day only. As this reduction amounts to one-third in Denmark the change will be important for the public. The state can, of course, take a view which may be awkward for a private line. Both may have to fear competition by other lines, boats, or conveyances, but government enterprise need not be managed on the principles of private companies. It is proposed to abolish turn tickets, and to issue direct tickets between all stations at greatly reduced rates. The highest third-class fare for any single journey in Denmark would be about six kroner, which would mean a reduction of 50 per cent. The railway department clearly risk a deficit, but they rely on the experience gained in Hungary and Austria. The freight rates are also to be modified in one respect. The highest rate for butter, eggs, and fish is to be abolished so that these goods will be transported at second class freight rate. But the empties of these articles will not be returned free of charge as heretofore.

CHEMICAL TESTS OF STEEL.—Much discussion has been engaged in by technical journals of late as to the real practicability of the popular chemical test employed in determining the character and quality of steel, says the Chicago Journal of Commerce. A strong opponent of the infallibility of the test system insists that instances exist where after the most rigid chemical analysis has determined two different brands of steel to be identical in merits and structure, use has shown one to be in every way superior to the other. Noticeably is this true in the matter of car springs, where certain manufacturers have won a reputation based solely on merits that do not appear upon a surface investigation. The specifications require a formal test, and this will be met by half a dozen different samples submitted, yet one certain brand will outwear the others. It is the same with Swedish iron, which is so successfully duplicated that the counterfeit stands the analysis without really possessing some of the eminent qualities of the original product. Recently the microscope has been called into requisition, and it is claimed that the result is to show decided minute differences where they really exist, and the difference shown bears an intimate relation more or less exact to the differences that a physical test indicates.

THE SHAFT OF THE LAVAL STEAM TURBINE.—In a shaft making several thousand revolutions per minute it is impossible to center the weight so accurately as to get completely rid of centrifugal force. In order to avoid vibration it has been customary in such cases to support the shaft so that the center of rotation is free to pass through the mass-center of the rotating body. In the Laval steam turbine, which in some cases makes 30,000 revolutions per minute, it has been customary to make the shaft so flexible as to offer very little resistance to bending, so that it may be possible for the principal axis of the rotating mass to coincide with the axis of rotation. At first sight it seems that if the shaft be slightly bent and then rotated, the unbalanced centrifugal force will tend to increase the bending. Mr. Klein, assistant of the Technical High School, Munich, made some experiments on the subject, and found that when a flexible shaft is set in rapid rotation it takes up automatically such a position that the mass-center lies on the axis of rotation, and shock from centrifugal force is thus eliminated. He also found that to obtain this effect the speed of rotation must have a certain minimum value; if this critical speed of rotation is exceeded the rotation goes on quite smoothly; if the speed of rotation be less an intense vibration is set up. The author gives an explanation of this phenomenon in simple non-mathematical language, which can be understood by any one having a sound knowledge of elementary mechanics. He then investigates the subject mathematically, and finds that the critical speed of rotation is given by the formula—

$$N = 300 \sqrt{\frac{P}{Q}}$$

where N is the number of revolutions per minute, Q the weight of the rotating body in kilogrammes, P the force in kilogrammes required to produce a deflection of one centimeter of the shaft. At N revolutions the vibration of the shaft is greatest; if the speed is increased beyond N a steadier motion is obtained. From the experiments it seems that for very steady running a speed of $1\frac{1}{2}N - 2N$ is necessary.—[Foreign Abstracts Proc. Inst. C. E.]

ICE BREAKERS.—In the Revue Technique, attention is drawn to a type of ice breaker which has been developed in the Netherlands. The information is evidently taken from journals of that country, but no definite quotation is made. Mr. Schurman is often referred to. The ice breakers, of which quite a number have been in use during the last five years, resemble the snow plows of locomotives, and are fixed to suitable vessels. The breaker is a sort of iron beak, wide, and rounded on the bridge, or more pointed with a sharp edge on the bridge, built up with strong iron ribs, forming a hollow spur which floats by itself, and into which the vessel slips from behind. The breaker is fixed to the vessel, rope and other things being interposed so as to make a tight, yielding fit. When in position, the tip of the beak will be under the water, and the beak is to run under the ice, and to lift and break it. This is deemed preferable to the opposite plan of crushing the ice by the weight of the vessel gliding on to it, because in the latter case, the broken slabs rebound against

the vessel and close the channel up again behind, whilst here the ice is more thrown sideways. More power must be needed in the former case, because the ice has to be raised, when it will no longer be borne by the water. Mr. Dibos does not touch upon this point. There is no doubt that these ice breakers have proved very suitable on the canals and in the ports of the Netherlands. One of them kept the Yop, the arm on which Amsterdam lies, open during February, and the Isploeg opened in 1891 a channel 45 miles in length in a day and a half. The power is not stated. The propellers of these boats are protected by "crinolines."

DINAS STONES.—Professors Seger and Cramer have been testing dinas stones from the dinas rock in South Wales, and other of similar compositions. Their chief object was to devise means of practical tests for highly refractory materials. They also ascertained that various German products were by no means inferior to the stones made from the real dinas. This dinas is essentially pure quartz containing 1 or 2 per cent of the oxides of iron and aluminum; the material is mixed with about 1 per cent of lime, and yields thus bricks which resist the highest heat. As fairly pure quartz is not of rare occurrence, the materials alone would not secure a monopoly to South Wales. The determination of exact temperature at which refractory stones give way is a tedious operation. The professors have hence constructed some five dozen of little pyramids consisting of quartz and lime, with varying additions of alumina and iron oxide, and further oxides of the alkalies and alkaline earths, also of lead, which are to act as fluxes. The pyramids form a series of pyrometers which soften and melt at increasing temperatures. The test piece is put in a Deville furnace together with several of these pyrometers.—[Thonindustrie.]

FIRE CAUSED BY RED LEAD.—In Uhland's Practischer Maschinen Constructeur Mr. T. Baumann charges red lead with having caused a fire. Smoke was issuing from a cellar in which a barrel containing 2 cwt. of red lead was kept. The barrel seems to have burst and the scattered mass to have charred some sacks lying about. The mischief had evidently only started a short time previous. The editors consider it very possible that the red lead should heat owing to further oxidation, and expand, and that the presence of oil or grease was favorable to spontaneous heating; they had expressed the same opinion on a previous occasion. We feel rather inclined to believe in a different kind of an oxidation process. The red lead was perhaps not higher oxidized but reduced, and the grease was oxidized. Dry red lead, pure, appears hardly likely to undergo any change at ordinary temperatures.

DRILLING ON A SHIP'S SIDE.—It is long since we heard of the proposal to attach a drilling machine to the side of an iron ship by the tenacious power of magnetism, says the Trade Journal Review, but the idea seems now to have taken practical shape. It may not be generally known to non-technical readers that there is an obstacle to drilling on the outside skin of a ship, owing to the absence of any holes whereby bolts may be put for attachment of the drilling apparatus. Holes through the sides of the ship are, of course, inadmissible, and there is really no other means available on the plain outside surface. Now there has been constructed a drill motor which, when suspended over the side, attaches itself firmly to any part of the smooth surface by the magnetism created by the currents of electricity used for driving the motor. It is, in fact, a powerful electro-magnet. The feet of the machine are the parts that cling to the surface, and these adhere so firmly to the ship that the drilling can be effected with perfect ease. When the hole is thus formed the drill is disconnected and the motor detached by turning off the current, and it is slung to another part to commence another hole. If this system of drilling should ever be extended largely the problem of making the holes in a ship's plates and angles in situ may be solved, and the separate punching be altogether discontinued. But that seems a far-off prospect. The punching bear rest secure for many years to come. It will be long ere its useful functions are superseded by any kind of drilling machine, electro-magnetic or otherwise.

A MODERN OIL CARRYING STEAMER.—An English journal states that recently another addition to Messrs. Samuel's fleet, known as the Shell Line, was made the other day by the launch of a large petroleum steamer from Sir W. G. Armstrong, Mitchell & Co.'s Walker shipyard. The vessel is a sister to the Nerite, which was taken for trial some time ago, and is now on her first voyage to the east. The trade in which these vessels are to be engaged consists of carrying cargoes to eastern ports and bringing home shipments of general eastern goods, including silks and other delicate fabrics, and even tea. To enable such a result to be attained elaborate cleansing and ventilating arrangements are provided, so that all trace of odor from the ore can be exhausted from the tanks and replaced by pure air. The vessel is minutely subdivided by oil tight bulkheads so as to keep the quantity of oil in each tank within the most desirable limits for distribution, with the result that it would be very difficult to sink the ship. A very large installation of machinery is fitted for working the homeward cargoes, so that no time may be lost in port, general cargo being discharged from every hatch at once. The principal dimensions of the vessel are: Length, 387 ft. 6 in., breadth, 48 ft.; depth, 31 ft. 6 in. The vessel was named Cowrie.

A CHARACTERISTIC OF YELLOW PINE.—An operator of long experience in the manufacture and use of yellow pine calls attention to a peculiar characteristic of the wood. This is the tenacity with which it holds nails. When once a nail is driven into a yellow pine board it is held without any show of loosening, no matter how much the structure is shaken by wind or the amount of vibration there is from any cause. A nail once driven never lets go, and it can hardly be driven out. This feature, it is concluded, renders a yellow pine house, or piece of work of whatever description, stronger and more capable of resisting the action of weather or any other disturbance than other kinds of lumber. On this account it makes excellent ma-

terial for car building or box making, in which resistance to perturbation, shaking or knocking about are important requisites. The same operator also says, that all heart yellow pine shingles constitute an unrivaled roof covering. Heart yellow pine resists decay many years; in fact it can be called almost non-rottable. Nailed to a roof, yellow pine shingles stay there, because the wood hugs the nails as tightly as if they were driven through a leaden plate. Heart shingles do not shrink or warp, but make a roof as solid, flat and tight as a slate roof.

PERMANENCY OF ANCIENT COLORS.—In ancient days, besides indigo and purple, few colors were employed, and these were obtained for the most part from the vegetable kingdom, but their purity was so great that they have kept well to our own times, after having undergone for centuries the action of the air and the sun. The fact is very remarkable in the Egyptian tombs; the stone has been disintegrated by weathering, while the colors have been preserved. The color that we meet most frequently is a mixture of reddish-brown oxide of iron (red hematite) and clay, known under the name of the Pompeian red. The color, which has resisted for 4,000 years the sun of Egypt and the action of the air, is equally proof against acids. The Egyptians reduced it by rubbing between stones, under water, to a degree of fineness that we cannot obtain nowadays by chemical precipitation. An equally precious metal pigment, also much used, was formed of a natural oxide of iron mixed with much clay, chalk and water, and browned by the action of the heat; this mixture gives orange. For this yellow color gold bronze or gold leaf was also employed. For blue they used a glass covered with copper minerals; this pigment was not less permanent than the preceding, even acids having very little effect upon it. Gypsum or plaster of Paris furnished white and also formed the base of pale colors when organic pigments were added to it, probably madder for red. The colors were always thinned and rendered adhesive by means of gums. It is interesting to know, as is proved by inscriptions, that the artists regarded their colors as imperishable.

FACE-HARDENING ARMOR.—A new method of face-hardening armor is being tried at the Pannier works. One face of the ingot intended for the armor plate is carbonized directly at the time of being run into the mold. This is effected by lining one wall of the mold with the necessary carbonizing material, which must, it is stated, be free from occluded gases, and of great durability, so as to remain stable during the process of casting. Experience has shown that the amount of cementation obtained varies with the carbonizing material used, about twice as much effect being obtained with charcoal as with coke. On withdrawal from the mold the cemented surface is slightly wrinkled, but this disappears in the after working of the ingot. The heaviest ingot yet dealt with in this way weighed 3 tons, and was reduced in its initial thickness of 16 in. to 4 in. by forging and rolling. An examination then showed that for 1-5 in. from the face the metal contained 1.78 to 1.50 per cent of carbon, which decreased regularly to between .25 and .15 per cent at the back of the plate.

THE GROWING REGARD FOR NATURAL SCENERY.—The movement to save the Palisades seems now in a fair way to be carried out. There is now a bill before the New York legislature providing for ceding to the general government that portion of the Palisades lying in New York state. A similar law is also before the New Jersey legislature. A bill has also been introduced into the house of representatives at Washington authorizing the purchase by the general government of 2,000 acres between the Hudson river and the Boulevard for a national park, which has been referred to the committee on military affairs. There now seems no doubt that the matter will be put through. In fact, the present prospect of it is so favorable that the quarrymen and some of the owners of handsome properties on the Palisades have taken alarm and are using their influence in opposition to it. It is believed however, that notwithstanding this opposition these laws will be passed and the present spoliation of this great natural breastwork stopped.

UNIFORM SYMBOLS.—At a meeting recently held at Springfield, Mass., considerable discussion was had on the subject of engineering formulæ and the use of uniform symbols. It is high time some common sense was applied in this matter. We have on all sides discussions and effort toward uniform standards, and here where most of all needed there is absolute chaos. The pedantry of mathematicians is proverbial, and its worst phase is in assuming special symbols, usually Greek or other unknown letters, and different from every one else. A very few have by the force of circumstances become constant, but there are not many. No one can realize until the matter is specially considered, the impediment thus set up to students, readers and every one who has occasion to analyze computations. The saving in space too is an important matter because the notation that must be given with formulæ written with arbitrary symbols, is commonly as long as an equation.

VARNISHES FOR IRON.—Mr. J. Spennrath, director of the technical school at Aachen, has been investigating the various paints, varnishes, and mixtures which are to prevent the rusting of iron. The Zeitschrift des Oesterr. Ingenieur und Architekten Vereins gives an abstract of his investigations. No paint or preparation can answer which changes its volume under the atmospheric influences. Zinc white absorbs carbonic acid and sulphuretted hydrogen, and therefore cannot last. Red lead may be transformed into sulphide, which occupies a volume greater by one-third. White lead is already a carbonate, and when mixed with resinous oil may prove suitable as long as the oil is not turned into resin. An atmosphere of sulphuretted hydrogen will turn the lead black, and in pure air the coating will become white again as the sulphide is oxidized into sulphate. When the oil is thoroughly seasoned, the oxidation is little to be feared. The author tested many special preparations, among others Graf's scaly armor paint, in which he found no scales, but irregular masses of iron oxide, besides silica and a little lime, magnesia, and clay. Graphite and red iron are

recommended. Special attention was paid to linseed oil varnishes. He stirred graphite into the oil, coated zinc foil with this mixture, dried, dissolved the zinc in diluted sulphuric acid, and kept the film of varnish for months in rain water, sea water, brine, acids, etc. Of the acids, nitric and acetic proved most destructive. Heat is a great factor for oil paints; corrugated iron, painted on the inside, peeled on those parts where the sun's rays reached the outer surface, but remained unchanged on the other portions. Tar paints are also noticed. For limited periods, grease preparations, mineral oils with magnesia, etc., will do good service.

TRANSPORTING A LARGE STERN FRAME.

The Paterson Iron Co., of Paterson, N. J., recently completed one of the largest wrought iron stern frames ever made in this country, as shown in the accompanying illustrations, for which with facts we are under obligation to Iron Age. The steamer for which this frame is designed is now being built by the Newport News Shipbuilding & Dry Dock Co., of Newport News, Va., and is for the Cromwell Line. The outside measurements of the frame are 21 ft. 2 in. by 28 ft. 10 in. The inside dimensions of the rectangular portion are 8 ft. 3 in. in width and 22 ft. in height. The hub is 37 in. in diameter and is 18 in. thick. All the other sizes are indicated on the plan view, Fig. 2, which shows the frame mounted on an ordinary platform car for transportation.

The frame was forged under a 10-ton steam hammer by the boss hammerman of the company, Richard R. Bergin, while the blacksmithing was done by the boss smith, William Le Guire, the entire work being done under the direction of Charles E. Beckwith, the superintendent.

The frame was so large that it was necessary to use both tracks of the Erie Railroad to transport it to Jersey City for shipment by boat to Newport News.

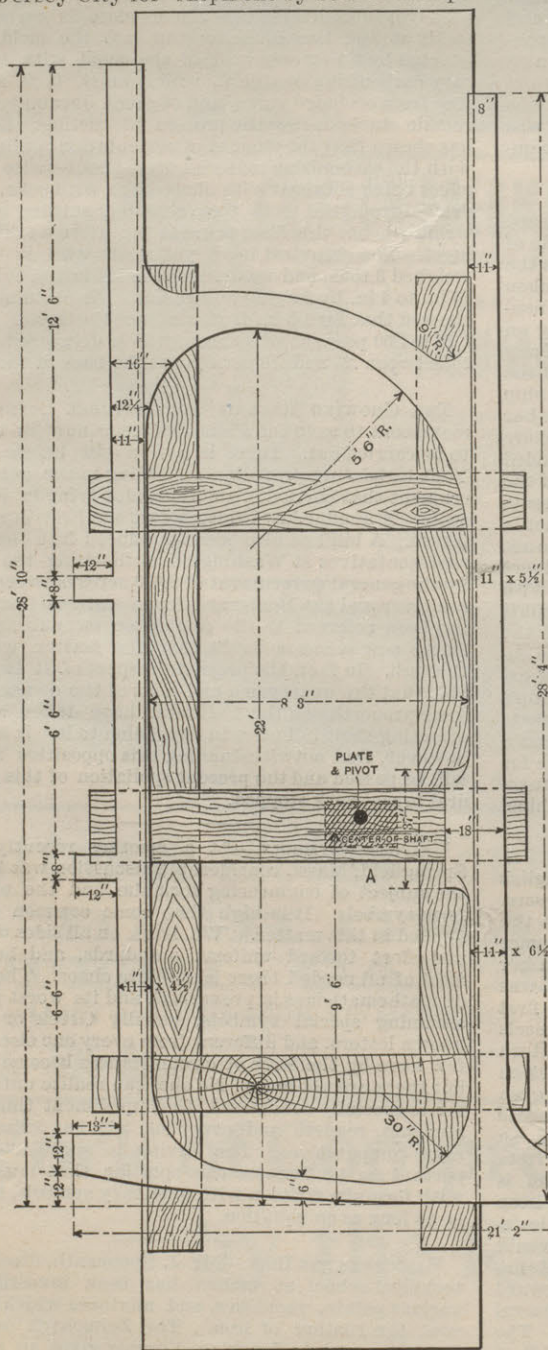


FIG. 2.—METHOD OF TRANSPORTING.

This would have been a simple matter if it had not been for the projecting foot B of the frame, which made the side dimensions over 22 ft. wide. Owing to this peculiarity of form it is found expedient to place the frame on a turntable on the car with the pivot at A, Fig. 2. Arranged in this way, the foot was the only part of the frame that extended over more than one track. The turntable permitted the frame to be swung around so that in taking it out of the yard to the main tracks certain signal posts could be cleared. On top of the car along each side was laid a heavy timber, upon which were secured three cross timbers. The plate and pivot were placed on the center cross timber at the point indicated in Fig. 2. A



A LARGE STERN FRAME—FIG. 1.—GENERAL VIEW.

special engine and crew conveyed the frame to Jersey City. Since the frame would occupy both tracks of the Erie, it was essential to move it when the traffic was smallest, and when the regular trains would be least interfered with. The start was therefore made at about 1:30 o'clock on the morning of December 16. The time in transit was about three hours. No trouble whatever was experienced on the road.

UNIFORM RAILROAD ACCOUNTING UNDER GOVERNMENT SUPERVISION.*

The commission has frequently been embarrassed by its inability to secure comprehensive information respecting the current condition of the business of transportation, and it will be universally admitted that the value of the service which the statistical division of the commission renders to the public would be greatly enhanced by a system of monthly reports. No serious difficulty ought to be encountered by the carriers in rendering monthly statements with promptness and accuracy, provided the forms for such statements were simple and clear, asking in effect nothing more than the gross earnings and operating expenses. Information of this sort is regarded with great interest, not only by investors in railway property, but by

all who concern themselves with current commercial conditions. Some years ago the statistical division undertook the preparation of such monthly statements. It was

found, however, that a few roads objected, and in view of the fact that under the law it was necessary to rely upon the courtesy of the carriers for furnishing the information, the policy of asking for monthly reports was abandoned. So great, however, is the importance of a comprehensive and uniform statement of the monthly earnings of railways, that the commission does not hesitate to urge upon congress such an amendment of the act as will make clear the authority of the commission to require such reports.

Congress has by previous reports been kept informed respecting the development of the statistical work entrusted to the commission, and for that reason it does not appear necessary to repeat this narrative at the present time. It does, however, seem desirable to state, as clearly and emphatically as may be in a few words, the reasons for believing that the ultimate success of the act to regulate commerce through the agency of commissions is more largely dependent on easy access to all the facts incident

*From advance sheets of the ninth annual report of the Interstate Commerce Commission.

to transportation than was appreciated even by congress at the time the act was passed. For this purpose it will be necessary to consider the service which may be rendered by a bureau of railway statistics and railway accounts in the enforcement of the act, and to point out in what particulars the act in its present form is inadequate to the development of such a bureau as these considerations contemplate.

A clear appreciation of the service of an adequately equipped bureau of railway statistics is only possible for one who understands the nature of the interests involved in the business of transportation, and who knows the peculiar danger to which each of these interests is exposed while the business of transportation is under corporate management. The interests involved are three in number, represented by three clearly defined parties or classes of persons. They are: First, the general public, whose continued prosperity (equitable and just conditions being recognized as essential to such prosperity) is dependent upon the way in which railroads are managed; second, those who hold the stocks and bonds of the roads, and those whose legitimate interest is confined to an equitable return on investment; third, the management of a road represented by the officers placed in charge of the property. It may appear strange, in view of the fact that the managers are appointed by the owners of the property, that the management should have an interest independent of the interest of the owners; but, unfortunately, this is the fact, and there is bound up in this fact many of the most serious mischiefs which exist in connection with railway affairs.

The guardianship of the public interest so far as interstate commerce is concerned is under the existing law entrusted to this commission. The nature of that interest consists primarily in just and equitable rates for transportation and in equal service for equal payment to all patrons of the railways; time, place and other conditions being taken into consideration. No one who understands the intricacies would care to assert that the determination of a just rate, or the decision as to what constitutes discrimination, is an easy task. To some extent the principles upon which taxation rests must be allowed in fixing a just rate; to some extent the result of the rate upon the development of industries must be taken into the account in all decisions which the commission is called upon to make; to some extent every question of transportation involves moral and social considerations, so that a just rate cannot be determined independently of the theory of social progress. This argument is perhaps as indefinite as it is comprehensive, but if understood it will be at once recognized that the commission cannot perform satisfactorily the task which congress has imposed upon it, except it is able to obtain easily and without obstruction every fact which bears on the relation existing between the railways and the general public.

* Elsewhere in this report, and frequently in previous reports, the difficulty of obtaining testimony pertaining to particular cases has been referred to, and recommended.

tions for amending the act so as to overcome that difficulty have been submitted to congress; but experience shows that no mere amendment in the method of procedure respecting evidence will enable the commission to secure all the information necessary to the easy enforcement of the law. Such amendments are indeed important, but in order to give the commission the information essential to a just opinion respecting a discrimination of rates, *the accounting department of the railways must be reorganized with that end in view.* If the interest of the public be a real interest, and of that there can be no question, the commission created by congress to represent that interest in the management of the property should have as free access to all the facts as does the board of directors, which stands for the interest of the investor.

The same conclusion may be reached in another manner. No one who studies the act to regulate commerce in its genesis and its history can avoid the opinion that its enforcement depends in large measure upon the hearty support of shippers who find themselves discriminated against by the carriers. These shippers must in some way be induced to bring their complaints freely to the commission; and this they will do, provided they may reasonably expect their complaints to be redressed in case the law has been violated. It is not, however, easy for a shipper to secure evidence of such a sort as will be accepted in a court, and on this account he hesitates to bring a complaint. The commission is, therefore, unable to exert that positive influence upon the policy of the carriers which the law contemplates. Such being the case, it is manifestly an essential step to the enforcement of the law against discrimination in railway rates, to create the condition in which such evidence as will insure the conviction of a carrier who violates the law may be obtained easily and in abundance. If, now, a system of general accounts were prescribed as minute and specific as the "classification of operating expenses," which the commission has already prescribed, and if all roads were obliged to conform to this system of accounts, and any deviation therefrom were made a misdemeanor under the statute, it is believed that the commission might secure adequate testimony not alone to satisfy itself, but to convince a court in case a particular company is guilty of violating the law.

Under a system of prescribed accounts an accounting officer would in a sense be responsible to the law for the condition of his books as well as to the management of the road. The facts of a case would then become manifest, and the commission would receive a sufficient number of complaints, assuming the occasion for just complaints to exist, to guarantee the enforcement of the act. In view, therefore, of the necessity of detailed information and of creating the conditions in which the law may become in a sense automatic in its execution, the commission does not hesitate to express the opinion that the auditors of the railway corporations should be brought under its direct supervision and that the accounts of the railways should be adjusted to the rules which it may prescribe.

It may be said that the commission now possesses the right to keep itself informed respecting the management of the railways. The twelfth section of the act to regulate commerce asserts:

That the commission hereby created shall have authority to inquire into the management of the business of all common carriers subject to the provisions of this act, and shall keep itself informed as to the manner and method in which the same is conducted, and shall have the right to obtain from such common carriers full and complete information necessary to enable the commission to perform the duties and carry out the objects for which it was created.

From this it might seem that the commission had adequate authority to secure all necessary information. A moment's reflection, however, shows that so long as each carrier is at liberty to formulate its own rules of accounts and to change these rules as often as it sees fit, the task is by no means a simple one. It is no light matter to understand a system of accounts of such minute details as are necessarily maintained by railway corporations. Only through long experience can an auditor become familiar with the system placed in his charge. How much more difficult, then, must it be for the commission, called upon as it is to consider the financial operations for more than 1,800 legally independent corporations, each of which may follow a different classification in the items of its accounts, and place a different interpretation on the words used, to obtain the information it needs by direct inspection of the books of a particular company. Doubtless, something might be done by the employment of expert accountants, but to say nothing of the expense and of the delay which this would occasion, experience declares that it would be inadequate. A uniform system of accounts, however, would in large measure remove this difficulty, since a careful study of one system would result in familiarity with all systems. Under such conditions the right to inspect the books of a company would become in fact as it is in theory, a power in the hands of the commission for the enforcement of the law.

Something of this necessity was doubtless appreciated by the framers of the act to regulate commerce when by the twentieth section, the commission was granted the right to prescribe uniform accounts. The language of this section is as follows:

Commission may within its discretion for the purpose of enabling it the better to carry out the purposes of the act, prescribe (if in the opinion of the commission it is practicable to prescribe such uniformity and methods of keeping accounts) a period of time within which all common carriers subject to the provisions of this act shall have, as near as may be a uniform system of accounts, and the manner in which such accounts shall be kept.

This clause of the law has received the serious consideration of the commission for a number of years, and some steps have been taken toward the attainment of uniformity in the rules adopted by auditors and comptrollers. If the accounts of the railways in the United States in 1887 be compared with their accounts at the present time there will be observed some considerable tendency toward uniformity. This has come about in large measure through the persistent though courteous insistence on the part of the statistical division that annual reports of carriers be drawn in accordance with the "instructions" prescribed by the commission.

It is readily admitted, however, that this is not adequate to attain the desired result. Although the wording of the law seems to be clear as to the right of the commission to prescribe uniform accounting, it may be doubted whether the section of the law which confers this right is sufficiently broad and comprehensive to justify positive action. The commission should have not only the right to prescribe a uniform system of accounting; it should be given authority to enforce the acceptance of such a system by simple process as well. It should be made a misdemeanor for an accounting officer to deviate from the rule prescribed. Moreover, provision should be made for a system of inspection similar to that of the comptroller of the currency over the accounts of national banks; in no other way can the commission be placed in easy and sure possession of the facts necessary to the performance of the duties imposed upon it. It is believed that provisions of this sort are logically bound up in the twentieth section of the act to regulate commerce, and the commission recommends that this section be so amended as to leave no doubt as to the purposes of congress in this regard.

In every proposal which affects the railway industry the interest of the proprietor should be considered equally with the interest of the public. The common objection against such a program as the above will undoubtedly be that it is an encroachment upon the private management of private property. It is not intended to discuss the broad and comprehensive question implied in this objection, it being sufficient for our present purpose to show that no class of citizens is more directly interested in the public control of railway accounts than investors in railway securities. So far as a system of accounting is concerned, the interest of the investor is identical with that of the public.

An investment in railway property is made by purchase of railway stocks or railway bonds. In theory the stockholder is a proprietor, and as such is at liberty to control the property of the corporation; in fact he delegates that authority to the board of directors, which in turn delegates it to corporation officials, and in some cases it must be admitted, the officials administer the business entrusted to them for personal rather than corporate ends. Instances of this are so familiar to all who are acquainted with the organization and administration of railways in the United States that illustration is unnecessary. Thus, not only is the public interest in transportation disregarded, but the proprietary interests of stockholders as well, and both the stockholder and bondholder, who have made purchase of these securities for the purpose of investment rather than of speculation, must approve any step looking toward securing to them the legitimate earnings of their property or of making their property more stable in value. Such results would undoubtedly follow should a uniform system of bookkeeping be established.

Public control over corporate accounts might justly be carried so far as to guarantee to investors the integrity of the statements upon which the value of their property depends. Such an episode, for example, as that which re-

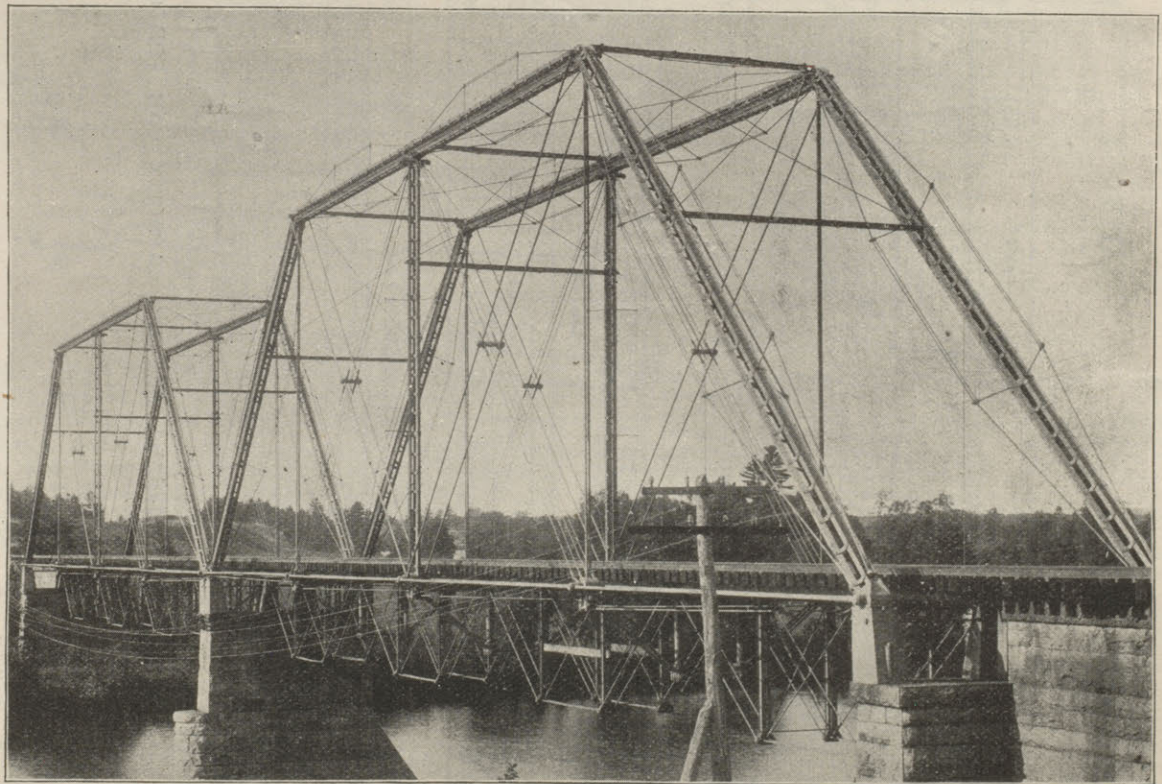
bookkeeping which the carrier shall be obliged to follow. In no other way can a just and equitable value be assigned to railway property, since in no other way can the earnings of such property be accurately ascertained. It is believed that the investor even more than the public would be benefited by public supervision over railway accounts. The only interest endangered by such a measure is that of the speculator, whose margin of profit is in proportion to uncertainty, and that of those railway officials who are not content with the payment of a salary, but who create an income incidental to the management of the property—an income which in many cases is the fruit of dishonesty.

The commission would by no means imply that corruption is the rule in railway management. It merely repeats what is universally known, that there are railway officials who, not understanding their office to be of the nature of a trust, use the authority conferred upon them for private advantages. Such officials would undoubtedly find much to criticize in the proposal here set forth. No legitimate objection, however, will be raised by those who recognize the fiduciary character of their office, and who desire to administer the property intrusted to them according to the requirements of law. On the contrary, such administrators would find that a uniform system of accounts would be of great assistance in such a management of railway property, as well as meet the requirements of public justice and serve, in the highest degree possible, the interests of the investor.

The general conclusion from the above discussion, which from the nature of the case has been cursory and incomplete, is that a uniform system of accounts under public supervision would be of great advantage, first, to the public, in that it would assist in the enforcement of the law; second, to the investor, in that it would assist in the securing to him the full earnings of his property; and third, to those officials of railway corporations who desire to administer the property intrusted to them honestly and in harmony with the law. The commission, therefore, does not hesitate to urge strongly upon congress the necessity of taking such steps as are necessary to the realization of an efficient system of supervision over railway accounts.

A DANGEROUS BRIDGE.

We publish herewith the illustration of a very remarkable bridge, which was in use for over fifteen years on a New England Railroad, but which has now been replaced by a modern structure. It was designed by the notorious Hewens, engineer of the "Bussey" bridge, which went down years ago under a train of the Boston & Providence Railroad. This fearful and wonderful design of a bridge was built in the master mechanic's shops of the road on which it was erected, and it looks as if it was the work of amateurs. It is true that the theoretical strength of the aggregation of its innumerable



A DANGEROUS BRIDGE.

cently startled the country, in which the official of a railway corporation deceived investors by erroneous charges amounting to millions of dollars, would not have been possible after ten years of successful operation of a system of public supervision over accounts. The many parasites also on corporate management by which profits are sucked up before the claims of stockholders are reached would be brought to light by a system of public supervision over accounts, and if exposure did not cause these abuses to disappear they might be dealt with in the light of explicit information.

Few persons appreciate the extent to which railway corporations are engaging in businesses outside the legitimate service of transportation, or the extent to which businesses legitimately a part of the transportation industry are delegated to outside agencies. The problem approached in this manner is indeed a great problem, and it may take years to work out of the confusion into which the supremacy of private interest in corporate management has brought the railway system of the United States, but respecting one fact there can be no difference of opinion, and that is that the first step toward this end is the development of a legally prescribed system of

members gave it a factor of safety of from three to five, but its astonishing trussing bears the same relation to its strength that the topmast backstay does to the topmast of a ship. The parting of the backstay always causes the loss of the mast.

Had any of these truss rods broken the bridge would have gone down. There were two spans of 152 ft. each, divided into four panels of 38 ft. each; the trusses were 38 ft. deep at the center. It will be observed that the end posts were inclined with an upright center post to divide the panels. Had a car door or some projecting timber hit the center post the truss would have gone down. The chords, end and intermediate posts were made of three I-beams fastened together by angle iron. The joint blocks were cast iron. It had a suspended floor system, trussed floor beams and stringers, and cast iron compression members in the floor beams. The end posts rested on cast iron truncated pyramids placed on low abutments.

The absurdities of its plan are apparent at a glance, and the fact that it never broke down is only to be explained by reflection that in union there is strength—providing nothing happens. This "aggregation" is now gone and it suggests the question, are there any more such crazy iron bridges in the country over which trains pass daily? The information was given under promise of withholding names, and perhaps it is better that this is so, as there are probably no more of these structures now in existence.

A SPECIAL CAR 120,000 LBS. CAPACITY FOR CARRYING CABLES.

The transportation of heavy cables has necessitated special construction of cars, and some of the designs for this purpose are exceedingly interesting. The accompanying illustration gives an excellent idea of the car which was built several years ago by the Wabash Railroad of which Mr. M. M. Martin is in charge of the car department. This car was recently used for the transportation of a heavy cable from

St. Louis to New York for the use of the Metropolitan Traction Co. and it attracted considerable attention.

The car is provided with four wheeled trucks and has a capacity of 120,000 lbs. These trucks are not materially different from the standard pattern for freight cars of 60,000 lb. capacity with $4\frac{1}{2} \times 8$ in. journals. They are of the diamond pattern, and have wrought iron bolsters of plates forming a truss which is 8 in. in depth at the center. The trucks are equalized in pairs by the equalizing frames shown in the larger views. The top center plate for each truck bolster consists of a casting 3 ft. 4 in. long, which is secured between two equalizer bars 9 ft. 11 in. long of 2 in. iron $4\frac{1}{2}$ in. deep at the ends, and 13 in. deep at the center. These equalizing bars also carry a casting securely bolted between them which takes the place of the ordinary truck bolster center plate upon which the center plate of the car body rests.

The total length of the car is 35 ft. over the end sills. There are six sills. The side sills are $5\frac{1}{2} \times 16$ in. and are of long leaf yellow pine. The intermediate sills are of the same material and are 5×9 in. in section. The center sills are $9\frac{1}{2} \times 12\frac{1}{2}$ in. of oak. The floor is of $2\frac{1}{2} \times 7$ in. oak, and is 8 ft. 3 in. wide. Upon the top of the floor two 12 x 12 in. timbers are secured just inside of the line of the inner face of the side sills, and these are secured in addition by cast iron brackets and short stakes. There are six truss rods $1\frac{1}{2}$ in. diameter of rod with ends upset to $1\frac{1}{2}$ in. The truss rods are carried over the body bolsters by means of flat connecting pieces of $\frac{3}{4} \times 4$ in. iron, the ends of which are upset to $\frac{1}{2}$ of an inch in thickness. The body bolsters are of 1 x 12 in. plates. The end sills are 8 x 13 in. and of oak. The construction of the bolsters and other details including the equalizers and center plates are clearly shown in the drawings.

The Pioneer Technical Schools.

In an address before the Engineering Association of the South, delivered at the annual meeting at Nashville, Tenn., on November 4 of last year, President Dudley gave a deal of information upon the early history of technical training. His subject was the "Development of Technical Education in the United States," and we are indebted to The Inland Architect and News Record for the following notes:

The first school in the United States to give a course of engineering was the United States Military Academy at West Point. The first two students who graduated as engineers graduated there in 1802. The military academy continued to graduate the only engineers in this country until 1840, when the Rensselaer Polytechnic Institute graduated its first class of 13 civil engineers, being the first graduates in civil engineering in any English-speaking country. The Rensselaer Polytechnic Institute was founded in 1824 by Stephen Van Rensselaer as a "School of Theoretical and Applied Science." In 1849 it was reorganized as a general polytechnic institute, and it still devotes itself to civil engineering, dividing the course into general and sanitary engineering.

The total number of engineering schools or schools giving engineering degrees, in 1889, was 94. Previous to 1802 engineers were self-taught, and from 1802 they were either trained in the office of some engineer or graduated at West Point.

Until recently in New England, and at present in old England, "students" or pupils were apprenticed—so to speak—to practicing engineers. This custom, however, has never prevailed to any very great extent in the west. No articles were signed by the "pupil," but he was supposed to pay \$100 per year for three years to the engineer in whose office he was serving, and he was paid 12½ cents per hour for his work in the field, which was credited on his tuition account. "After the war" this system began to die out, and the pupil was paid 12½ cents for his office work, as well as field work, and in this way he could frequently more than pay his tuition. This, however, did not cause any loss to his "instructor," because his services were charged at a rate of from \$2 to \$6 per day, according to the skill of the pupil. By this system the pupil learned much or little, as he chose. He asked such questions as he pleased, and got such answers as he could, but what he learned he usually learned well, because he put into practice immediately and constantly what he learned.

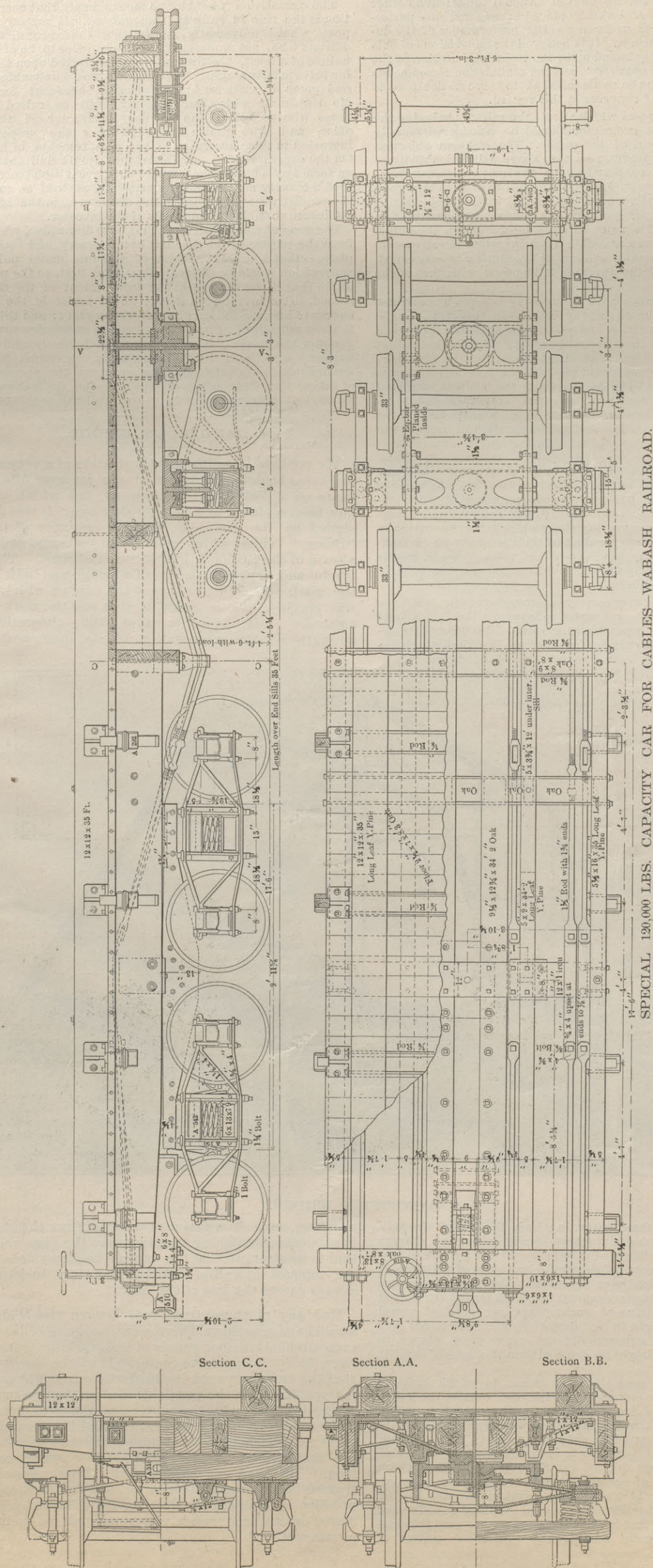
Up to 1830 the word engineer conveyed to the minds of the vast majority only the idea of a military officer. The phrase civil engineer had been but lately coined. In 1828 the Institution of Civil Engineers was incorporated in England, and when civilians assumed the title they incurred the wrath of the military men. In 1835 the Rensselaer Institute first resolved to form a distinct "Engineer Corps," receiving on graduation the "Rensselaer Degree of Civil Engineer." As we have seen, their first class graduated in 1840.

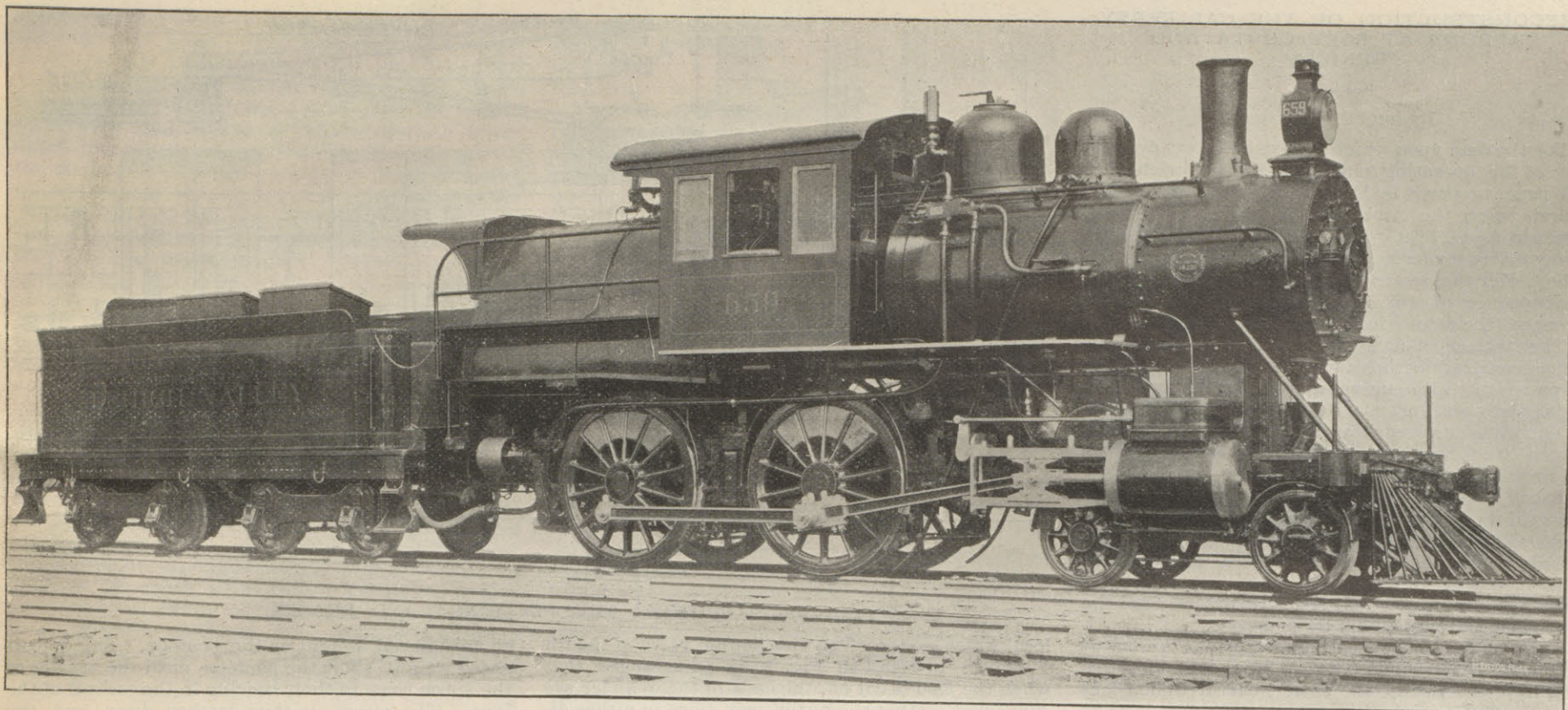
The School of Engineering of Union College, at Schenectady, New York, founded in 1845, was the second in the United States. The third was the Lawrence Scientific School at Harvard, founded in 1846. The fourth the Sheffield Scientific School at Yale, founded in 1847, nominally, but was not a live and active school until 1861. The fifth was the Engineering Department of the University of Michigan, founded in 1852. The sixth, the Brooklyn Polytechnic Institute, founded nominally in 1845, but did not begin graduating until 1866. The Columbia College School of Mines was founded in 1863 and opened in 1864. It was the first school in the United States in which mining was taught as a science. Here the college course in mining engineering started in the United States.

The Massachusetts Institute of Technology was incorporated in 1861 and began operations in 1865. In 1868 the first class, composed of thirteen, graduated.

The first degrees in mechanical engineering were conferred in 1868 by three institutions—Rensselaer conferring five, Yale one, and Massachusetts Institute of Technology one.

Stevens' Institute was founded in 1870; its electrical course was instituted in 1880. Sibley College, Cornell,





WIDE FIRE-BOX LOCOMOTIVE, LEHIGH VALLEY RAILROAD.—BALDWIN LOCOMOTIVE WORKS.—FIG. 1.—GENERAL VIEW

was founded in 1870. The first civil engineering degree was given in 1871. In 1875 the course in electrical engineering was instituted, as well as a course in marine engineering.

The latest course in engineering is chemical engineering, which is given at the Massachusetts Institute of Technology.

BALDWIN LOCOMOTIVE WORKS WIDE FIRE
BOX LOCOMOTIVE LEHIGH VALLEY R. R.

One of the recent designs for heavy wide fire-box passenger locomotives which has attracted a great deal of attention is that recently designed by Mr. Samuel Higgins, superintendent of motive power of the Lehigh Valley Railroad. This is said to be one of the best steaming engines on the road. It is illustrated herewith. The Baldwin Locomotive Works has built several of these engines which are very heavy and we believe have, with the exception of the new Pennsylvania Class L engines, the greatest weight upon drivers yet employed. As shown by Fig. 1, which was taken from a photograph, the engine is of the eight wheel type.

The boiler is straight and is shown in longitudinal section in Fig. 2. Fig. 3 gives a half section and half elevation of the fire-box showing the method of staying, the width of the water leg and the shape of the fire-box sheets. The boiler pressure is 160 lbs. The seams are quadruple rivetted butt joints. The shell is 61 in. in diameter at the smoke-box end, and the dome which is 31½ in. inside diameter is placed centrally and is secured to a base plate. There are 248, 2 in. tubes 13 ft. 7½ in. in length. The fire-box is 119½ in. long inside by 82 in. wide, and is designed for burning anthracite coal. The water spaces are 4 in. in width all around. The grates are rocking and water tubes. The truck wheels are Catsaqua steel tired and 33 in. in diameter. The piston rod and valve stem packing is United States metallic. The valves are the Richardson balanced. The driving axles are of steel with journals 8½ in. in diameter by 11½ in. long. The driving

boxes are of steeled cast iron with brass bearings. Two Metropolitan injectors are supplied, and the other accessories are Leach sander, Snow air bell ringer, 16 in. round case head light, American outside equalized brake on drivers and Gould coupler on pilot and tender. The boiler is lagged with wood. The cab is built of steel and is lined with wood.

The cross-heads are of cast steel and the guides are of the two-bar type of hammered iron case hardened. The connecting and parallel rods are of steel. The crank pins are of steel and the eccentric straps of phosphor bronze. The driving wheels have Latrobe tires on cast iron centers. The brakes are supplied with the Ross steel shoes. The forward driving springs are above the frames and the rear springs

Cylinders.....	20x24 in
Boiler.....	straight
Diameter of barrel, inside.....	59 1/2 in
Thickness of plates.....	9-16 in
Thickness of smoke-box plates.....	1/2 in
Height from rail to center.....	100 1/4 in
Smoke-box, length of.....	61 in
Steam pressure.....	160 lb

Fire-box—

Length, inside.....	119 in
Width, inside.....	82 in
Depth in front.....	50% in
Depth in back.....	47% in
Thickness side and back plates.....	5-16 in
Thickness crown sheet.....	% in
Thickness tube sheets.....	% in
Grate area.....	67.7 sq. ft
Water space, all around.....	4 in

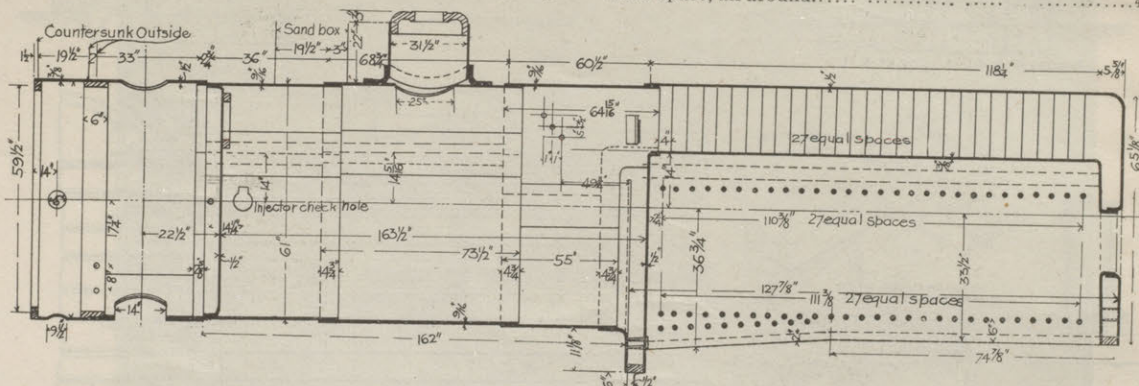


FIG. 2.—LONGITUDINAL SECTION THROUGH BOILER AND FIRE-BOX.

are placed between the bars of the frames and rest against the top bar. The main equalizers are placed between the bars of the frames. The tender has a capacity of 4,000 gals. and is supported upon a steel frame carried upon Fox pressed steel trucks with McKee, Fuller steel tired wheels 33 in. in diameter, and National Hollow brake beams. The tender carries eight tons of coal.

For convenience the chief dimensions and weights are arranged in the following table:

Tubes, (iron), number.....	248
" diameter, outside.....	2 in
" pitch.....	2 1/2 in
" length between sheets.....	13 ft. 6 1/2 in
Ratio heating surface to grate.....	28 to 1
Ratio tube area to fire-box heating surface.....	11.2 to 1
Heating surface tubes, exterior.....	1,755
" interior.....	1,517
" fire-box.....	157
" total.....	1,915
Exhaust nozzles (double).....	3 1/2 in
Drying wheels, diameter.....	68 in
" centers.....	62 in
Truck wheels, diameter.....	33 in
Tender wheel, diameter.....	33 in
Engine truck.....	swing bolster
Journals, driving.....	8 1/2 x 11 in
" truck.....	5 1/2 x 9 in
" tender.....	4 1/2 x 8
Wheel base, driving.....	7 ft. 9 in
" " truck.....	6 ft. 2 in
" " engine, total.....	22 ft. 7 1/2 in
" " tender.....	15 ft. 11 in
" " total engine and tender.....	49 ft. 10 in
Weight on drivers (working order).....	90,000 lbs
" truck wheels.....	38,500 lbs
" total of engine.....	128,500 lbs
" tender (working order).....	84,000 lbs
" engine and tender, loaded.....	212,500 lbs
" tender, empty.....	36,420 lbs
" coal.....	8 tons
" water, full tank.....	33,280 lbs
Capacity of tank.....	4,000 gals
Distance center to center cylinders.....	77 in
Piston rod.....	3 1/2 in
Ports, length.....	17 in
Ports, width, steam.....	1 1/2 in
Ports, width, exhaust.....	3 in
Outside lap.....	7/8 in
Maximum travel of valves.....	5 1/2 in
Lead, full gear.....	1-16 in

The June Conventions.

Messrs. Woolley & Gerrans, proprietor of the Grand Union Hotel, Saratoga, have decided to open this splendid hostelry for the accommodation of those attending the Master Car Builders' and Master Mechanics' conventions at Saratoga next June. The house will be opened on the 15th, and a special rate of \$4 per day will be made for members and their friends.

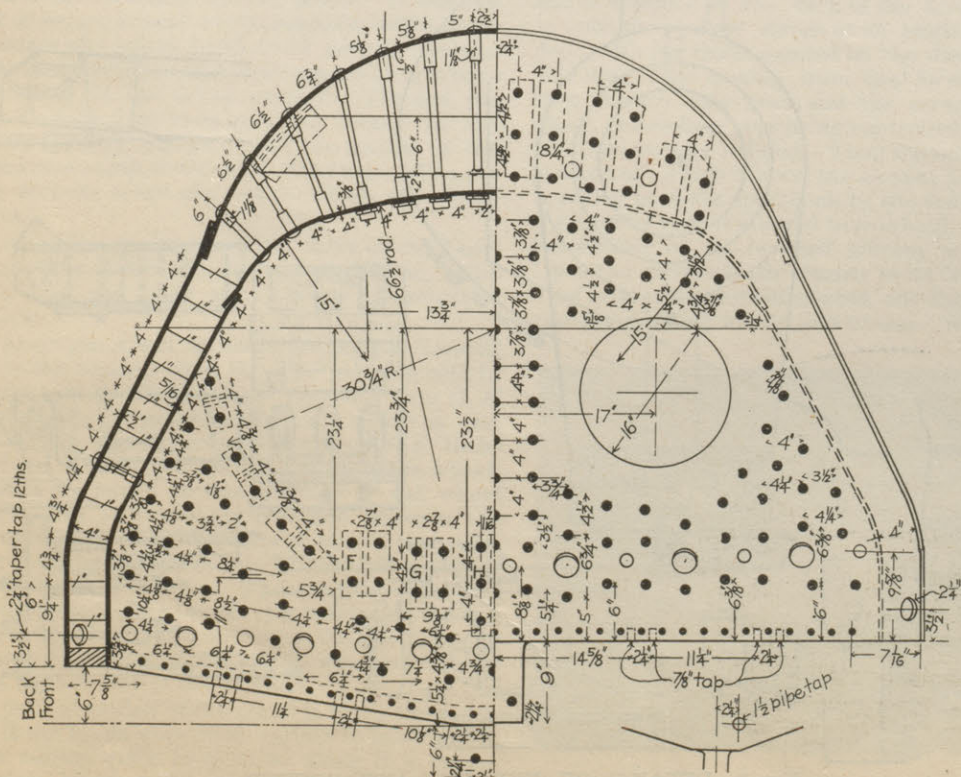


FIG. 3.—HALF SECTION AND HALF ELEVATION OF FIRE-BOX.

RECONSTRUCTION OF THE CAR FERRY APRONS AT PORT COSTA AND BENICIA*

By JOHN B. LEONARD.

For the data upon which I have based my description of the operating machinery, I am indebted to the paper prepared by Mr. A. Brown and read by Mr. Harris before the American Society of Civil Engineers in April, 1890. I also wish to acknowledge many favors tendered to me by Mr. F. Teichman, who, under the supervision of the engineer of the maintenance of way department of the S. P. R. R., prepared the details for this work.

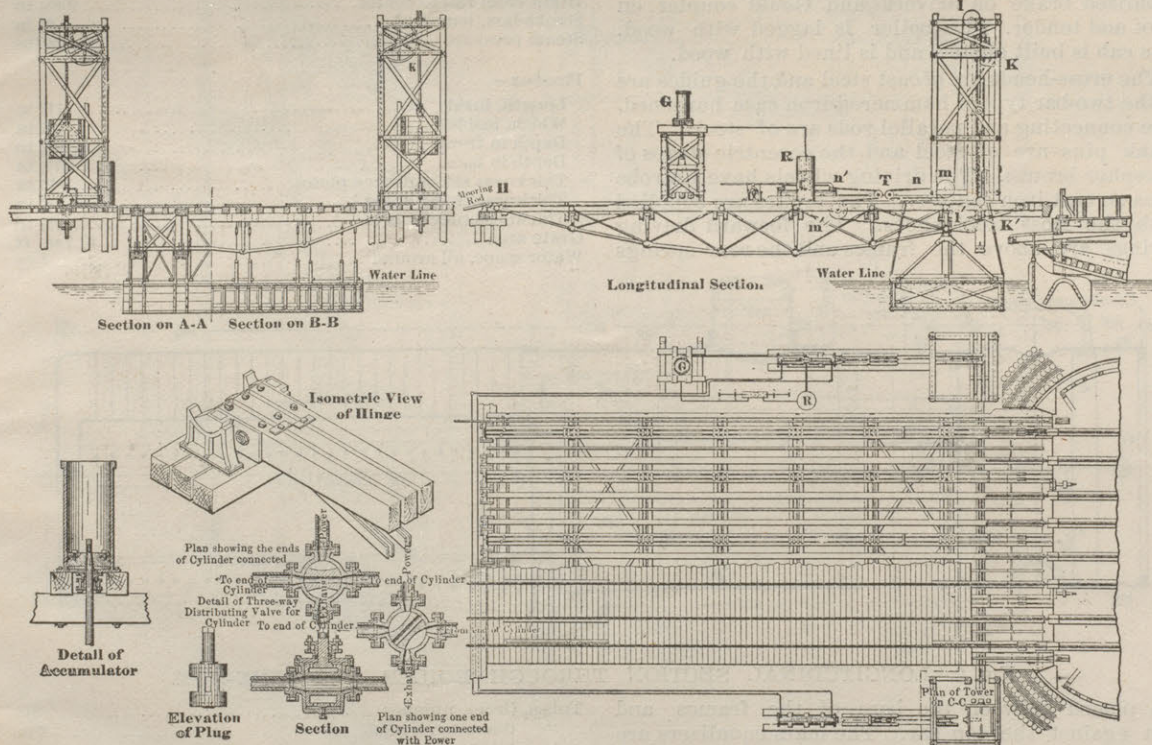
The steamer "Solano" was built in 1879 for the purpose of transferring a train of cars (48 freight or 24 passenger, with engine) across the straits of Carquinez between Port Costa and Benicia.

The transfer aprons that I will attempt to describe to you are for the purpose of connecting the tracks on the wharves with those on the boat.

It had for some time been apparent to the engineers of the maintenance of way department of the railroad, that the construction of these transfer aprons was much too light for the present traffic. The increased volume of business and the much heavier rolling stock that is now being used are the reasons for strengthening these aprons.

Fig. 1 shows the general details of the aprons as originally constructed. The apron, as reconstructed, will have practically the same general dimensions as those of the original apron, i. e., 100 feet long by 44½ feet wide, and will carry four tracks similar to those on the boat. The apron will consist of five longitudinal bowstring trusses, and a system of transverse floor beams carrying intermediate track stringers.

One end of the apron is at all times supported by



PORT COSTA AND BENICIA CAR TRANSFER APRONS—FIG. 1—GENERAL VIEWS.

the wharf, and is also hinged at this end. The other end is supported by means of a submerged pontoon and counterweights, but during the operation of loading or unloading, additional support is given by the boat.

The supporting capacity of the pontoon is 95 tons, and of the counterweights 25 tons, making a total supporting capacity of 120 tons. An excess of supporting capacity to the proportion of static load that is carried at the free end, is for the manipulation of this end of the apron. The machinery for doing this will remain the same as in the original construction.

At the first panel point from the free end, the apron will rest on the pontoon. At a distance of 12 ft. 1½ in. from the free end there will be a transverse bowstring truss, the ends of which will be secured to the counterweights. This transverse bowstring truss will transmit to the longitudinal apron trusses the supporting power of the counterweights. The wire rope which connects the ends of the transverse truss to the counterweight is double and continuous, and passes around equalizing sheaves both at the truss and counterweight. The pontoon is connected to the apron in such a way as to resist both tensile and compressive stresses.

The power for operating the counterweights is derived from a hydraulic lift. From the top of the box containing the counterpoises, the chain *K* passes partially around the sheaves *l* and *m*, the crosshead *T*, and is secured at *n*. From the bottom of the counterweight the chain *K'* passes similarly around *l'* and *m'*, and is secured at *n'*. The water is supplied from the accumulator *G*, into which it is pumped from the tank *R*, on the Benicia side, by an electric motor. On the Port Costa side the tank *R* is situated on top of a hill and is supplied by the

*Abstract of a paper read before the Technical Society of the Pacific Coast, published in the Journal of the Association of Engineering Societies.

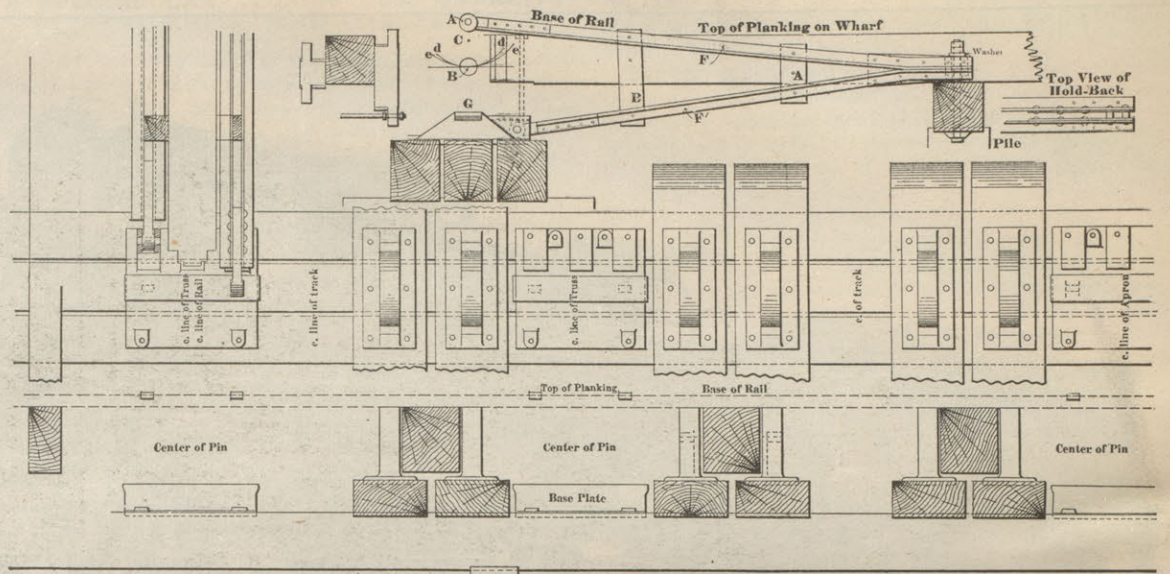


FIG. 2.—SHOWING THE PIN HINGE AND BRACER.

local water works. The distribution valve of the lift *T*, shown in detail on Fig. 1, is so arranged that when the feed is cut off, the ends of the cylinder are connected, so that the piston may move in either direction, the water in the cylinder merely circulating around, thus permitting the end of the apron to rise and fall with the tide or the boat.

The action of the free end of the apron is as follows: the excess of the supporting capacities raises the apron above its bearing in the cockpit of the

an unbalanced weight on the pontoon. This unbalanced weight sinks the pontoon until the trusses of the apron come to their bearing in the cockpit of the boat. The apron is then latched down and the counterweights released. The boat is held up to the apron by means of two mooring rods *M*, which extend the length of the apron, are hinged at *H* and bolted back to the piling as shown. The rods *M* are connected to the boat by means of links and tightening levers. The apron is now free to follow the fluctuations of the boat due to loading and unloading or the rise and fall of the tide. Upon unlatching the apron the unbalanced weight immediately raises the apron free from its bearings. The object of connecting the crosshead *T* to the bottom of the counterweight is to keep the piston always in a position ready to act at once.

The two outer trusses of the apron will carry the outer rails of the outside tracks on their top chords, while the other rails will be carried by 14x16 track stringers which rest on the transverse floor beams.

The trusses are of the pin-connected combination type of construction. Each truss has six panels of 13 ft. 3 in. each, and one 18 ft. 3 in., making 99 ft. 3 in. center to center of end pins, and a depth at their center of 8 ft. 6½ in. center to center of pins. The depth of the trusses was limited by the distance from the base of the rail on the boat to the loaded water line. The form of the trusses is such as to secure very nearly the same maximum stress in each panel under the conditions of maximum loading for such panel.

The trusses are built in duplicate for the sake of economy in the cost of manufacturing and erection. The only places where there is any excess of material are the web systems and bottom chords of the outside trusses. The transverse stresses of the top chords in these trusses, in addition to the longitudinal stress, require about the same sectional areas as are used in the other trusses.

The maximum unit strain in the tension members will be 15,000 pounds per square inch, and this strain will occur only when trains are on adjacent tracks.

The top chords of the trusses are built of three pieces of Oregon pine, 8x16 in., and two 15 in. steel I-beams, 41 pounds per foot. The 15 in. beams are placed one on each side of the timber chords, the

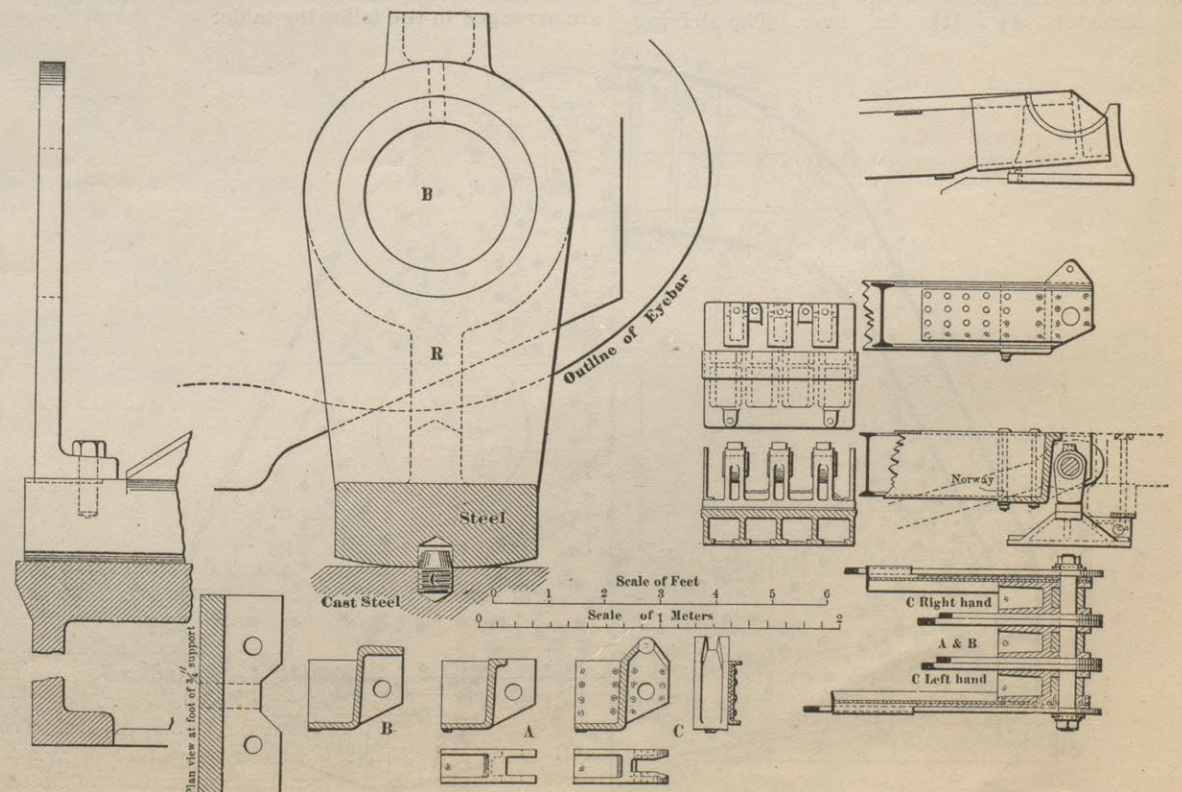


FIG. 3.—DETAILS OF END PIN AND ROCKER.

timber being framed so as to fit snugly up against the web of the beam. The web members are connected to this chord by means of pins, these pins having bearings in castings. The castings rest on top of and are bolted to the vertical posts and project up between the leaves of the timber portion of the chord, into which they are framed. The diameter of the pin hole in the timber is such as to make a snug fit, while those of the beams are $\frac{1}{4}$ in. larger than the pin. In this way all of the horizontal components of the diagonal web members are transmitted to the timber portion of the chord. At the ends of the trusses the beams are riveted to the castings, and both beams and timbers come to a bearing on the pin. To insure the timber coming to a firm bearing in the castings, iron wedges will be driven in the joints at the ends of the timbers.

The reasons for building the chords in this way are these: First, it was found to be much cheaper than an all iron construction, one item in favor of the cost of this construction being that the most of the cast iron is taken from the old work. The limited time in which to perform the work was a very important factor against an iron truss or girder. An all timber chord could not be used because it packed out too wide horizontally with a 16 in. depth, and to increase the depth of the timber sufficiently to permit it to be packed in the horizontal space available, would decrease the depth of the truss, or in extreme cases dip the bottom chord too much into the water.

For proportioning the chord sections the moduli of elasticity of timber is taken at 1,800,000 pounds, and of steel, at 29,000,000 pounds. Since the two materials will resist the stresses in proportion to their rigidities, which from the above moduli are found to be nearly as 16 to 1, the sectional area of the timber to the steel is as 16 to 1, as near as commercial sizes will permit.

Furthermore, it is found practically impossible to bring the apron to an exact bearing in the cockpit of the boat, there being a play of about $\frac{1}{4}$ in. between the sill of the apron and its bearing on the boat, under favorable conditions. The sudden loading of the apron caused by the train coming on from the boat, immediately deflects the end of the apron to its bearing. To overcome the inertia of the counterweights and the pontoon, a transverse bending strain is produced in the end panels of the top chords.

A variation in the elevation of the sides of the boat during the operation of loading or unloading, produces a torsional action in the apron. Experience has shown that the action of the bending stresses and the stresses caused by the torsional motion of the apron are very destructive to a timber chord. It is believed that the addition of steel beams to the chord section will prove advantageous in resisting such stresses.

The variation in temperature has been assumed as 40° between extremes. With the work placed in position at a mean temperature, the 40° variation will cause a difference in length of the timber and iron sections of about $\frac{1}{16}$ in. The deflection of the pin will be sufficient to overcome this variation.

The stringers at the wharf end will fit into a casting which will have projections on its sides. The projections will be in the form of a segment of a curve, and will extend out from the face of the casting. This projection will rest in a socket of a similar concave curvature, in a pedestal casting which rests on the wharf. In this way an axis of rotation for the stringers is provided.

For the trusses the problem is very different. An inclination of the apron above or below the horizontal line passing through the hinge creates a thrust or pull at the hinge which must be resisted.

A large radius for the rolling face was necessary in order to secure sufficient bearing power. It was also sought to secure a detail which would cause the apron to automatically adjust itself to its normal position when horizontal. These conditions are believed to have been fulfilled in the detail adopted. The end pin *B* (Fig. 3) of the truss rests upon the rocker *R*, and transmits through it to the wharf the portion of the load that is brought to this end of the truss. The pin *A* (Fig. 2) is the hinge pin, about which the apron revolves.

The point *C* is the center of the curve of the bearing face of the rocker, the radius being 18 in. The end pin *B* of the truss is 7 in. below this center of curvature.

The hinge pin *A* is 11 in. above the end pin *B*, and 22 in. above the bearing point *G*. The pin *A* is held in a position that is at all times vertically over *G*, *G* being the center of pressure when the rocker is vertical. This is done by extending braces *F*, *F'* backwards from *A* and *G* and securing them to the wharf. The struts are joined to one another at the wharf end, and also at points intermediate between the wharf connection and the points *A* and *G*, thus completing the triangle of bracing. There are a pair of these braces to each truss. The apron is connected to the hinge by giving the pin *A* a bearing in the end casting. The horizontal motion of the pin *B*, due to the extreme position of the apron, was found to be about $\frac{1}{4}$ in each side of the vertical.

The path of motion of the pin *B* is along the curve *B, e*. If the hinge were held rigidly in position, its path of motion would have to be along *B, d*, consequently the hinge *A* will have to be deflected a dis-

ance equal to the space between the two curves *B, e*, and *B, d*. This distance was found to never exceed about $\frac{1}{4}$ in., a deflection which will be given by the elasticity of the strut with ease.

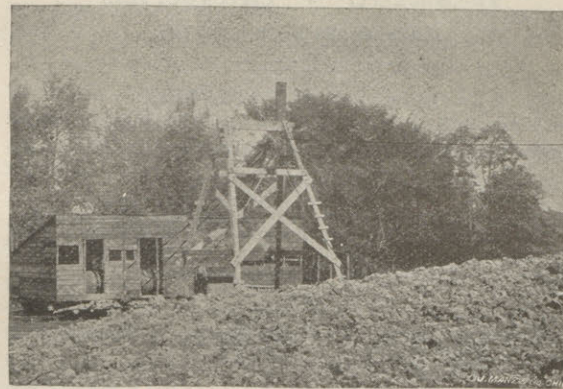
The point *B* being below the center of curvature of the rolling face, the tendency of the apron must always be to return to its normal position. The stress produced in the strut *F* when the point *B* is at its maximum distance from the vertical line, is about 1,400 lbs. To prevent the rocker being lifted off its bearing through any blow or shock, the tap bolt *C* is placed in the pedestal.

A SELF-FILLING SCRAPER.

An interesting piece of apparatus for handling soft material on section six of the Chicago Drainage Canal, patented by the contractor, Mr. Charles Vivian, and built and controlled by the Lidgerwood Manufacturing Company, is shown in the accompanying illustrations, which were made from photographs of the work upon this section. About 119,000 cubic yards of the top muck upon this section was removed with this scraper which was filled, conveyed and dumped by steam power furnished by an engine contained in the cabin shown at the left in Fig. 3. This apparatus consists of the scraper, the form of which is shown in Fig. 2, which is pulled back and forth between two towers placed at either end of the ditch to be dug. The scraper is drawn by ropes of crucible steel 1 inch in diameter. The towers are mounted upon cars running upon a temporary track, so that the entire plant may be moved

the engine is reversed and the endless rope returns the scraper to the cut allowing the drag rope to overhaul. The ropes employed are clearly shown in Fig. 1. The method of unloading is shown in Fig. 2, in which the endless rope is employed in dumping the scraper.

The engine employed is a Lidgerwood double cylinder 10x12 in., with double friction drum hoist and



LIDGERWOOD CONVEYORS.—FIG. 3.—POWER CABINS.

differential brakes on each drum. The endless rope drum is 54 in. in diameter, and the drag rope drum 30 in., the drums being arranged in tandem. Steam is furnished by a Lidgerwood 60 h.-p. locomotive fire-box boiler. The force required for operating this



LIDGERWOOD CONVEYORS.—FIG. 1.—CARRYING LOAD.

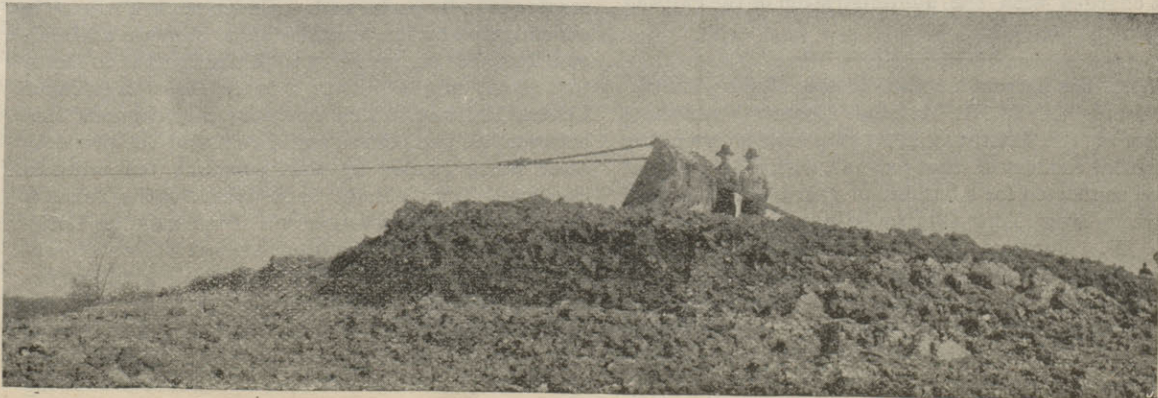
along with the progression of the work. In this respect the scraper outfit resembles the cableways, illustrated in the RAILWAY REVIEW of January 19, 1895, page 35.

The scraper is operated as follows: An endless rope which runs from the rear drum of the engine and is attached to the back of the scraper is pulled in until the scraper stands at an angle of about 45° , with the brake applied on the drag rope drum. The drag rope coming from the forward drum is then thrown into gear and the scraper is pulled along, the endless rope being controlled by the brake until the scraper is filled. Then the endless rope is slackened off, which allows the scraper to turn, and it is pulled in to the spoil bank by the drag rope, while the endless rope is allowed to overhaul. Fig. 1 shows the scraper on its forward journey with its load. Upon the arrival of the scraper to its destination the drag rope is thrown out of gear, and the endless rope thrown in, which upsets the scraper. When emptied

apparatus consisted of an engineer, fireman and two signal men. Many difficulties were encountered such as boulders and trunks of trees, but five hundred cubic yards were often removed in ten hours. The scraper is especially adapted for handling sand and gravel, and for railroad construction work wherever a deep cut and high fill adjoin each other. The scraper used on this work was 5 x 5 ft. x 2 ft. 6 in. with a capacity of three cubic yards. It was run at a velocity of 600 ft. per minute and weighed 2,700 lbs. The span between the towers in this case was 420 ft., though this distance may be increased where occasion requires.

Civil Engineers' Club of Cleveland.

The regular meeting of the Civil Engineers' Club of Cleveland was held in the rooms of the club, Case Library Building, Tuesday evening, January 14, 1896, at 7:45 standard. Mr. Walter Miller read an interesting paper entitled: "Quadruple Expansion Engines for Lake Service." Mr. W. W. Sly gave an illustrated talk on "Tunneling Machinery."



LIDGERWOOD CONVEYORS.—FIG. 2.—DUMPING LOAD.

THE RAILWAY REVIEW

OFFICE OF PUBLICATION:

The Rookery, - CHICAGO, ILL.

Eastern Office: 189 Broadway, New York.

TERMS OF SUBSCRIPTION:

Per Year..... \$4.00
 Foreign Subscription (including postage)..... 5.00
 Convenient binders sent postpaid for \$1.00.

PUBLISHED EVERY SATURDAY: Subscribers are requested to give information of any irregularity in receiving THE REVIEW.

Rates of advertising made known on application.

All remittances should be by Draft, Express, or Money Order, payable to THE RAILWAY REVIEW.

Address all communications to THE RAILWAY REVIEW, The Rookery, Chicago.

CHICAGO, SATURDAY, FEB. 1, 1896.

ELSEWHERE in this issue will be found extracts from a report of a sub-committee to the rivers and harbors committee of congress upon a resolution introduced by Mr. Griswold of Erie, Pa., calling attention to the lowering of the lake levels, and directing the secretary of war to investigate the subject of means to guard against any further lowering of the levels. This resolution should pass, and with correct data at hand as to the amount of outflow at each of the narrow channels of the lakes system, the subject may be attacked intelligently and doubtless one of the incidental advantages of this information will be to set at rest the calamity howling of which the Chicago drainage canal is the subject. Whatever the probable effects of this water course there is great need of reliable figures upon the outflow of the lakes and the survey ought to be made.

THERE is no accounting for the ups and downs in business prices demand and supply especially in the iron trade. Enormous sums have been lost in a speculative way on Bessemer and billets. Trade is at last on a stable basis and possibilities of an upward tendency in prices are now in sight. The strong point in the background of trade is the enormous requirements in every direction. Every interest has put on the brakes. Production is still being restricted. Pig iron makers have pulled down prices without enticing buyers. Bar, plate, sheet and rod mills are not doing as much as prior to the holidays. Steel rail makers have no explanation to give of the prolonged postponement of anticipated spring orders. A good run is assured on girder rails. Mill and machine shop machinery will soon be under contract according to advices from machinery centers. The public mind is needlessly unsettled on minor matters, but these will ere long fade from the horizon and the spring impulse will soon be felt in all trade channels.

In the report of the railroad commissioners for the state of Connecticut for 1895, which has just been received, special reference is made to the enactments of the last session of the state legislature prohibiting the further construction at grade of any crossing of steam railroads, either by similar roads, or by electric, cable or horse railroads. As might have been expected, this legislation was objected to by the promoters of some of the last-named enterprises, but inasmuch as provision was made for an appeal to the commissioners to order a separation of grades where such lines desired to cross a steam road, it was felt that no injustice would follow; which conclusion in the absence of any such appeal to the commissioners would seem to have been fully warranted. The report of the commission in question is very complete, and reflects credit upon the very able board at present charged with the administration of the railway affairs of that state.

WITH the current number of the *Railway Master Mechanic* Mr. W. H. Marshall (formerly associate editor of the *RAILWAY REVIEW*), retires from the editorial conduct of that journal, with which he has been connected for a number of years. Mr. Marshall goes to New York City to be associated with Mr. M. N. Forney on the consolidated *American Engineer, Car Builder and Railroad Journal*. During the time that Mr. Marshall has been connected with the two first above named papers he has acquired a reputation for vigor of thought and boldness of expression not exceeded by

any writer on the technical press. Although an eastern man by birth Mr. Marshall has an abundance of western progressiveness, and while pre-eminently careful and painstaking in his investigation, he nevertheless never hesitates to deal with any problem in the line of mechanics, however new or novel. The consolidated journal to which Mr. Marshall goes cannot fail to be much benefitted by his connection with it, and his many friends will unite in wishing him all manner of success in his new connection.

ONE of the anomalies of railway operation is the varying estimate placed by railway officials upon the sacredness of contracts. It would be a homily well worth the hearing if some patrons were permitted to listen to the evidences of the regard with which contracts are held by railroad men when a discussion concerning the restoration of rates is in progress in a traffic association meeting. In such an event there would be no manner of doubts in their minds that the wide spread opinion as to the looseness with which such contracts are regarded by railway men was altogether wrong, and that no men were more solicitous about carrying out their agreements than these same much maligned traffic officers. And they would be right. No set of men on earth hold with more integrity to the fulfillment of their agreements—with patrons; but the strange thing is that apparently no class of men on earth have less regard for their agreements with each other. An instance in point is the present controversy over the Grand Army rates to St. Paul. By agreement with each other the roads in the Western Passenger Association are bound to observe certain conditions which prevent the issuing of tickets as desired by the Grand Army people. This agreement is in writing and is subscribed to by the ranking officials of all the roads. But there is on the other hand a verbal agreement by one of the roads which conflicts with the terms of the larger and more important contract; and strange as it may seem the minor agreement is held by the road in interest to be the more binding of the two. Nor does the added fact that a compliance with the verbal agreement means the utter demoralization of the passenger revenues of all the roads concerned, while the reverse would be true in case of the observance of the other, appear to have any influence in the matter. As stated in the beginning this condition of things is one of anomalies of the business—a condition that is likely to continue until a way of relief under the law is supplied.

THE Railroad Commission of Texas, which is nothing if not unique, has added another to the many rulings already promulgated by it that wisdom would have suggested had better be let alone. The commission has ordered that every railroad company operating a line of railroad between points within the state of Texas, and receiving any loaded or empty car or any article of freight for transportation over its line to a point on its line, or over its line to a point on any connecting line, shall in the transportation and delivery of such loaded or empty cars or article of freight, respect and be governed by the routing thereof designated by the shipper, in every case in which the shipper shall direct the route. All of which is simply another instance of the application of ignorance to the problems connected with railroad transportation. Shippers have the undoubted right to select the carrier to whom they shall deliver property for transportation, and also to direct the point at which the property shall be delivered at destination, but when the carrier has entered into an obligation to so accept and so deliver the property, the shipper is estopped from further direction as to the means employed. So long as no unnecessary delay ensues the contracting carrier may use its preference as to route. To hold otherwise would subject it to all manner of imposition, and necessarily absolve it from all responsibility. A carrier cannot be held to guarantee the transportation of property within the limit of a certain time and stated charges, unless it is free to select the means whereby such service is to be performed. Under such a rule as is promulgated by the commission a shipper at Denison, Tex., having property to be transported to Houston, Tex., might deliver it to the Houston & Texas Central Railway, which operates a continuous line between the two points, and direct that the property after being hauled by that company ten miles to Sherman, Tex., should be delivered to the Texas & Pacific for transportation via Texarkana to Longview and thence via the International & Great Northern to destination; all of which which would be extremely absurd, but nevertheless possible. It is not probable that such an order would stand the test of the court, and on that account is not likely to be respected, but it is nevertheless significant as showing

to what lengths an otherwise intelligent body of men will go in connection with subjects on which they are uninformed.

The order above referred to is worthy of notice as affording another illustration of the necessity of retaining railroad commissioners in office long enough to become in a measure familiar with the requirements of transportation service. In most states particularly in the west, rotation is the rule in this connection; and as a result the men to whom are committed the most important interests of the states are not permitted to remain in office long enough to be of any practical service to the parties they represent. It is a mistake to suppose that in all this the railroads are the only sufferers, and that therefore, no harm comes to the people of the state. The railroads are powerful corporations and so far as their obligations under the law are concerned are ably handled, and being continually put upon the defensive meet ignorance and prejudice with ability and craftiness. It is no wonder, therefore, that in such states the railroad situation is unsatisfactory to all concerned; and the strange part of the whole proceeding is that given such examples of harmony and efficiency as may be found in some states where the office tenure of the commissioners has been long continued, these states do not learn the lesson and endeavor to profit thereby.

RULES FOR OBSERVANCE.

There are many rules which are supposed to be in force for the government of employes in the transportation department of railways which have become outgrown and are relics of early days when trains were few and the business of transportation was more a matter of leisure than at the present time. One of these rules applies to automatic block signals and provides that when a train arrives at one of these signals, if it is found at danger, shall stop and wait a certain number of minutes for the signal to clear. If the signal does not clear in that time the train is to be flagged through the block. Such a rule applied to single track roads, protected by automatic signals, is really necessary, but the application referred to is when tracks are used in one direction only. It has been argued that the worst effect of a rule of this kind is to delay traffic. This, however, is not the case, for it is perfectly safe to say that no considerable amount of traffic is interfered with by such rules, for the reason that they are regularly violated, and the question very properly is raised as to why such rules are allowed to stand in the codes. The following is a case in point: A road with track circuit automatic signals with two mile blocks, required all trains to be flagged between signals in case of their remaining at danger after the expiration of the time limit. A through passenger train came up to a signal and stopped as required. The signal engineer of the road happened to be aboard and stepped off to see what the matter was, and in so doing was recognized by the brakeman, who at once told the engineer that he had better carry out the rule in this case, and off the brakeman started on his two mile walk, with the train following him at a pace of about three and a half to five miles per hour. Complaint of the passengers finally caused the conductor to take the matter in hand and he called in the brakeman and proceeded with reasonable speed. The signal engineer after studying the situation decided to take up what he called this "fool rule" with the general superintendent who did not look at the question in the same way as the signal engineer, and promptly announced that he would give the train crew a suspension of ten days, but as the signal engineer was possessed of a convenient memory and had forgotten the exact date and train number he was unable to locate them.

This is a course which should not be pursued blindly, but there would seem to be no good reason for demanding that a man shall precede a train through a block under such circumstances when all that is necessary is that the speed of a train shall be so reduced as to enable any danger to be discovered in time. In the particular case referred to the automatic signal was out of order, and one-half at least of the delay was unnecessary. It is perfectly safe on double track for a train to proceed past a danger signal as far as the way is known to be clear with the speed under control so that a derailment would not occur in the case of encountering a broken rail or coming upon another train. One of the strongest arguments for the use of track circuit is that it permits of the detection of broken rails, and upon this same division of the road above referred to, two such cases were brought to light within a few months. To use the expressive phrase of the signal engineer mentioned, the general non-observance of

these rules is a clear case of "wink" on the part of the officers of the road who do not pretend to enforce them, except in cases of violation to which their attention happens to be called. The real reason for the existence of this rule is that superintendents fear that unless actual flagging is required a safe speed will be exceeded. As a matter of fact a locomotive runner is about as much interested in the speed question as anybody concerned in such a case, and it seems merely necessary to insure beyond a doubt that the impression is made upon his mind that he has passed a signal in the danger position, and that he must consequently, be looking for trouble. It is as easy to enforce a sensible rule as it is the one requiring flagging, and there would seem to be nothing to be lost in so framing the rules that they will mean what they say. From the standpoint of the men it would seem to be an effort to work with them in good faith if they were not given the impression that rules are given for the purpose of trapping them. It may be a matter of surprise to some that rules like this are allowed to remain in force, but it is thought that an examination of the regulations on the lines employing automatic signals would reveal more than one such case.

TRAIN DETENTIONS.

An interesting paper, an abstract of which appears in this issue, was presented before the New York Railroad Club at a recent meeting by Mr. Mendenhall upon the subject of train detentions, in which there is much that is suggestive in regard to the running of trains so as to insure their being more uniformly on time. In the discussion of the paper one of the speakers made the statement that the best solution of the difficulty was to run trains on time, because a train on time seldom gets into difficulty. This is a axiomatic, but the point involved is a good one, owing to the fact that a train once behind its schedule on a busy road, is generally obliged to take considerable buffeting, and do a great deal of dodging to prevent interference with other traffic. It is a very common thing for trains to be delayed at stations and for the officers of the road to expect that the time will be made up between stations by extra exertions of the engine crew. This practice is not only wasteful but it is likely to cause more serious trouble because of increased speed between stations necessary to make up time. On a great many roads the motive power officers seem to have a clear case against those who are responsible for the long delay at stations, and if this discussion brings this fact home to the men who need to consider it, the result cannot fail to be good.

It is admitted by Mr. Wattson, himself a superintendent, that leaving the engine and car failures out of consideration, the superintendent can control about everything else in the way of delays. This is undoubtedly true, because the majority of the delays are at stations, and are due to what might be called in general terms, lack of discipline, and may be prevented by insisting upon promptness in getting away from stations, and also requiring freights to keep out of the way of passenger trains. The method employed by one superintendent of inflicting a penalty of one day of suspension for every minute a passenger train is delayed by a freight had a remarkably good effect, and while there seem to be differences of opinion in regard to administration of punishments the idea contained in this plan is excellent. The matters of discipline to which superintendents need to give most attention is in the transfer of passengers and loading and unloading of baggage and express matter. The principal trouble at stations seems to be that the brakeman figure that it will take the locomotive runner about five minutes to look around and oil up, the locomotive runner counts on about the same time for the passengers to get out and in, the baggage to be transferred and mail and express matter handled. The express and mail men often overrun the time which is required for the other work, and it is so easy to put the blame upon some other department or person that no one feels responsibility for the delay. There are many roads to which these remarks do not apply but in the majority of cases some, if not a great deal of improvement in these matters can be made. If mail and express men find that trains will not wait for them they will see that sufficient help is had to meet the requirements. If baggage men delay through trains on account of large amounts of matter to handle they should be provided with assistance, and if this should increase the wages account there is a corresponding gain by not forcing the locomotive to such a high degree beyond its efficient capacity.

The loss of a minute at one station is not a serious matter, but one or two or three minutes at each of thirty stations gives the trouble which causes the

complaint, and would undoubtedly lead to much more complaint if such tests as were recently carried out by the Chicago, Milwaukee & St. Paul Railway, and recorded in our issue of January 25, page 45, were more general. The "step lively" plan pursued upon the elevated railroads is the solution of the passenger difficulty, and it is thought that all the other delays may be reduced in corresponding proportion. As confirming this belief it might be well to mention that recently when one of the important trunk lines was trying the paces of a new passenger locomotive with an extremely heavy train a few energetic remarks by an officer of marked executive ability in the form of the superintendent of motive power, who was interested in the performance of the engine had the effect of reducing the time spent at stations to about half its usual amount. This shows what may be done, only the energetic language should emanate from the transportation department, which is really the more interested party.

The motive power department officers, however, should not take too much comfort from this discussion. In many cases they may improve their end of the situation by urging engineers to lose no time, and by the attention which they pay to the reports of engineers in order to get them as correct and complete as possible. It is for the interest of this department to reduce the station delays as much as possible, and there is much which by co-operation with other departments can be done in such matters as providing large spouts at water tanks, and by careful study of train sheets. A plan has been successfully tried on one large road of sending telegraphic reports of delays to the superintendent of motive power, who holds the division master mechanics responsible for any which are caused by failure or defect of equipment. The division master mechanics follow up the engineer's reports, and the two reports, one coming through the general superintendent from the conductors and the other through the engineers, can be compared. We have heretofore held that speeds while running are only a part of a rapid transportation. Speed while standing at stations is equally important as speed when running, and when the fact is realized that all time lost has to be paid for in extra consumption of fuel, this will probably be remedied to a great extent. The final analysis of the question is the financial one, and upon that point the coal bill is an important factor.

THE ENGLISH CAUTION SIGNAL.

In glancing over the proceedings of the American Railway Association and other technical organizations of railway men, the amount of attention which the question of signaling has occupied during the past five or six years is very striking. While a great deal of the discussion has borne valuable fruit a large majority of it has not resulted in any practical good or any reform over the complexity of methods and the complication of systems which have existed and do exist at the present time. Among the subjects which have received the great amount of attention are those pertaining to night signaling and great efforts have been made by nearly all of the associations interested to solve the problem in a satisfactory manner. The use of the white light as a safety indication is responsible for most of the unrest in the minds of signal men and superintendents who desire to embody consistency and safety in their systems, and were it not for the fact that a distant signal is necessity the solution would consist of the adoption of green for all clear in place of white, red being retained as a danger color.

The joint committee of the American Railway Association on interlocking and block signals in its report of April, 1895, seems to think the danger of using white as a clear indication is overestimated. It is stated in this report that "some earnestly insist upon the total exclusion of the white light, believing that red, green, and their combination will afford all that is necessary. Others quite as vigorously contend that the relinquishing of white as a signal at this time would be not only injudicious but impracticable, and involve difficulties which the members of the association should not be called upon to encounter. The fact that on British railways the use of white has been discontinued has received the fullest consideration, but when consider that in a country where block signaling is many years older than in America, it is only within a year or two past that some at least of the most important lines have discontinued the use of white, the conclusion seems to be justified that had the objections to the white signal been so formidable as many now assert the experience of those lines would long ago have impelled a change."

Under the influence of these considerations the

committee did not deem it wise to recommend abandoning white for a night signal at that time, because "three indications are necessary in many cases and no satisfactory single color has been found for a third indication. The committee approves, however, the use of red for danger—stop, and green for clear—proceed, as good signal practice." The committee then recommends experimenting with a combination of red and green for a cautionary indication, on account of favorable results which have been reported with this arrangement on some important lines.

The committee shows itself to be in a dilemma, and its recommendation merely holds the question open for further discussion, with an implied wish on the part of the committee for the adoption of the combination caution indication, and, if nothing better can be found it is probable that this signal will eventually be adopted. The mountain which blocks the way is the elusive third color for caution. It has been repeatedly stated that English roads get along very well with their system, which does not include cautionary indications on distant signals, and in correspondence with a prominent signal engineer in England a reply was received that he could not bring himself to appreciate the need for a cautionary signal. Another signal engineer well known on both sides of the Atlantic, writes so as to convey the impression that while formerly this opinion was held, that of late the English idea had changed somewhat and that a caution signal is now admitted to be frequently necessary. The solution of the color question for night signals in this case is interesting, and further than this it seems as if the English engineers had found what is for them a perfectly satisfactory way out of the difficulty, and without recourse to a combination of colors. The signal referred to is the "calling on" arm. It is an arm of reduced size fixed below the main signal arm. The interlocking is so arranged that when the top arm is cleared the "calling on" arm is locked at danger, and vice versa. The small arm shows no light when at danger, and gives a small green light when cleared. The rules on the Lancashire & Yorkshire Railway for working these signals are as follows:

When the calling-on arm is lowered the home signal will be at danger, and vice versa.

No light will be exhibited at night when the calling-on arm is at danger, but when the arm is lowered a small green light will be visible.

Drivers must bring their train to a stand when the home and calling-on arms are at danger, and when the line upon which the train will travel is blocked, but sufficiently clear to admit the train, the signal man will lower the calling-on arm, which will authorize the driver to draw slowly and cautiously forward, but only so far as the line is clear. When the home signal arm is lowered drivers may proceed forward.

Signal men must not lower a calling-on arm until the approaching train has been brought to a standstill at it.

If such a signal with such rules was to be adopted in this country it would seem to meet the requirements of the distant signal admirably without the employment of a third color, and without the objection which has been raised to a combination of red and green in one signal. The distant signal would be distinctive, as many hold that it should be, and it would require a stop when in the caution position. White would not be used at all and green could be used for all clear. With such a signal an engine runner seeing the top arm at danger and a small green light below it, would know that the line ahead was not clear throughout and that he must proceed to the home signal cautiously. There are some objections which may be raised to the application of this form of distant signal, but its advantages are suggested here in the hope of leading to a discussion of this plan.

THE GENESIS AND PROGRESS OF A GREAT RAILROAD SYSTEM.

The Boston & Lowell.

(Continued from page 17.)

We now come to the absorption of the third of these old railroads which began life at about the same early period in railroad history, viz., the Boston & Lowell. This road had been trying in a spasmodic sort of a way to grow great, but with rather doubtful results. Beginning in 1836 with 15 miles of road from Boston to Wilmington Junction on the Salem & Lowell, and turning its passengers into Lowell over that line, it soon afterwards leased the Salem & Lowell. Then it got possession of the road from Lowell to Nashua with its branches, and was known for a while as the Boston, Lowell & Nashua. About this time the Boston & Maine built a branch into Lowell, and the B. & L. promptly built one into Lawrence. Heretofore each of these companies had done all the business for each of these great mill cities separately and without friction, but now a fierce rivalry commenced. In the vicinity of 1885

the Boston & Lowell leased the the Boston, Concord & Montreal Railroad and the Northern New Hampshire Railroad properties, about 350 miles long, and operated them for several years, having to use the Concord road for 35 miles, from Nashua to Concord, to get its rolling stock from one part of its system to another. The Concord Railroad, then wealthy and independent, refused repeatedly to come into either the Boston & Maine or Lowell Companies, and the three-cornered fights over attempts to get it form a large part of the history of New Hampshire for many years. The Lowell's operation of the B., C. & M. was never satisfactory. It also leased the Passumpsic Railroad, and obtained control about this time of the St. Johnsbury & Lake Champlain Railroad, which remained under its own name. It had also leased the Central Massachusetts from Boston to Northampton, 105 miles, after that company had failed to earn even its operating expenses. Then it had the Wilton Railroad and the Manchester & Keene Railroad, which gave it 565 miles of line in all. This amount of track rather over loaded the Lowell, as much of it was not paying property, and it lent a more willing ear to the Boston & Maine proposals for a lease, which finally was agreed upon.

When the Boston & Lowell was leased by the Boston & Maine in 1889 litigation was resorted to, and its leases of both the Boston, Concord & Montreal and of the Northern (N. H.) Railroad were set aside by the courts, and these properties reverted to their owners. The Boston & Maine then promptly leased the Northern road (main line Concord to White River Junction) and a short time afterwards a union was made of the Concord Railroad and the Boston, Concord & Montreal Railroad, under the name of the Concord & Montreal Railroad. This left the old gap of foreign road to be run over by the Boston & Maine between Nashua and Concord, N. H., to get from one part of its system to another. With all of its vexations, the Boston & Maine bided its time and "lay low" awaiting developments. Next came the stiff fight of 1892 with the New York, New Haven & Hartford to see which should have the Connecticut River Railroad system of 130 miles, and the B. & M. won, adding this much to its system. The Connecticut River road was a good paying property, but it came high at the price paid (over \$200 a share), there being two wealthy bidders for it. Then followed the famous protocol in which both the N. Y., N. H. & H. and the Boston & Maine promised to be good, the former agreeing to let the railroads north of the Boston & Albany alone and the latter covenanting not to "gobble" anything south of the B. & A. Then, as we have before said, it came about that by the decision of the courts the Concord Railroad, now Concord & Montreal, was decided to owe the Manchester & Lawrence, now Boston & Maine, three-quarters of a million dollars. It tearfully admitted that it could not pay it and that \$200,000 more was needed to be spent on its own property in new bridges, etc.

Here was the long waited for opportunity and a lease of the whole property was at once proposed by the Boston & Maine. This was last July (1895), and the proposition was promptly accepted by the Concord & Montreal stockholders, and thus 410 more miles were added to the Boston & Maine system, making it, in all, 2,078 miles. In addition to this the Boston & Maine owns entire the York Harbor & Beach road, 12 miles, and through the Eastern Railroad, three-fourths of the stock of the Maine Central, which operates 900 miles of road, and 200 of steamboat. The Maine Central is absolutely independent, although harmonious in its operation, yet should, to gether with the little York-Beach, be included in the Boston & Maine system. This, leaving out the steamboats, brings a grand total of about 3,000 miles of road under this control, and all in New England, and it is a pretty big road for any locality.

Having traced the rise and progress of the Boston & Maine from a 78 mile road to a 3,000 mile "system," we will now take a look at its present operation and traffic. It might be well to mention here that the efficient President of the company, Mr. Lucius Tuttle, was general passenger agent of the old Eastern Railroad in 1880, before any of these leases were made, and also held the same position on the Boston & Lowell leaving it for the Canadian Pacific just before its lease to the Boston & Maine. Before proceeding further it will also be of interest to give a list of the presidents of this company, with the years of their administrations. The first of whom I have record was a Mr. Spellman, who held the office in 1865 and 1866; then Francis Cogswell, from 1866 to 1874; N. G. White, from 1874 to 1884; George C. Lord, 1884 to 1890; Frank Jones, 1890 to 1892; A. A. McLeod, 1892 and part of 1893; then Frank Jones again from spring to fall of 1893, when Mr. Lucius Tuttle entered upon the discharge of these duties. Of the other officers the most widely known was James T. Furber, who became superintendent of the road in 1873, having risen from the ranks, and its vice president and general manager in 1889, dying in that position in 1892. The present general passenger agent, Mr. Dana J. Flanders, rose from a telegraph operator, and later superintendent's clerk, to his present title at 24 years of age, being the youngest general passenger agent then in the serv-

ice. He has been at the head of the passenger department for over 20 years, and seen the roads under his charge grow from 78 to 2,000 miles. He got out the first folder ever used giving excursion rates, and hotel and boarding house prices at all of the resorts on his lines. These have since been copied all over the country. Mr. Flanders is only middle aged now and full of vigor and enthusiasm for his life work.

In connection with the general officers of this company, mention should be made of Mr. Wm. F. Berry, now second vice president in charge of the traffic department. Mr. Berry at the time of the consolidation was general freight agent of the Eastern Railroad, and shortly was placed in the same position on Boston & Maine. From that he became general traffic manager, which position he filled until his recent election. His long experience well qualifying him for his present position.

The Boston & Maine is one of the two or three railroads in this country whose passenger earnings always exceed its freight earnings. During the last fiscal year ending June 30, 1895, it carried 32,380,242 passengers, of which 20,700,010 went in and out of Boston. Its total passenger mileage was 444,496,640, and its passenger earnings per mile of road operated were \$6,667.48, and per train mile, \$1,310. This was a slight falling off from the previous year, owing to electric competition. This vast passenger business required the use of only 321 passenger locomotives, the company owning 570 in all, some freight engines being used on passenger trains in times of extraordinary demand, and 1,014 passenger and other cars, showing the great number of short runs. The total gross transportation earnings for the fiscal year ending June 30, 1895, were \$16,892,313.84, and the net transportation earnings \$5,097,785.54, a considerable increase from the \$482,657 of 1863. It must also be borne in mind that the Boston & Maine has to compete with sea and river transportation at many of the largest cities on its line, thus losing many thousands of tons of coarse freights, such as coal, lime, granite in various forms, lumber, etc. For this reason it uses but 9,023 freight cars, a small number for its mileage.

A resume of the growth of this railroad would be incomplete without a glance at its new station on Causeway street, Boston, on ground formerly occupied by the Lowell station, which is incorporated in it, the old Eastern station, and the old B. & M. freight-houses. This station is called the Union station, because the Fitchburg has been brought into it thus doing away with several dangerous grade crossings. It is also a "union" of the three great divisions of the B. & M., which had heretofore used three separate stations. The station is on made land and has an entire frontage of 568 feet on Causeway street, of which 363 feet is new and 205 feet is the Lowell station, which was comparatively new. The principal feature to the eye of the front of this station is the main entrance, which is a very massive granite arch 80x70 feet high composed of fluted granite columns and an arch. It is heavy enough to carry a 20-story building, yet has only about 50 feet of pediment to support. This is supposed to be ready for the next new station which will sometime be much higher than the present one which suffers architecturally from so much of the front being no higher than the train sheds. But said to be their intention to some time build a more substantial station with trains entering on the second floor so that the tracks can cross Charles river out of the way of row boats. The inside of this station is roomy and convenient and is handsomely finished. There is a covered "cochere" with room for two dozen cabs under it, and all of the apartments and conveniences are of the latest design and usefulness. Special attention has been given to making it comfortable for the great number of people who use this station daily, for they average 70,000, including Fitchburg Railroad 80,000, and there are plenty of doors everywhere. The train shed is 540 feet long and 472 feet wide, laid with 23 tracks in it and on these tracks 650 trains arrive and depart daily, or more than twice the number that go in and out of the grand central station, New York, every 24 hours. To understand this, one must reflect that while Boston has but 500,000 people in its city limits, there is another million in the surrounding towns and cities of this thickly-settled region who conduct their business in the city, and of this suburban population over 500,000 people go in and out again on its railroads every week; or 1,000,000 both ways. On a recent Knights Templars' conclave at Boston, the West End Street Railway took over 800,000 fares in a single day and a large majority of these fares in 15 hours. Of the Boston & Maine management, it can be said that it is conservative and safe, and they seldom have any accidents to passenger trains or rarely injure a passenger in any way, which is an excellent record for a road that carries over 33,000,000 people a year; but its train-running might be much quickened.

The frequency and convenience of the trains is unquestioned, but it has never been noted for fast schedules. It has as far back as the memory of man runneth paid from 6 to 10 per cent. dividends unfailingly, but the traveling public would no doubt appreciate faster express trains. The distance to Portland by the Western division is 115 miles and the fastest expresses take 3 hours and 15 to 45 minutes or 195 to 225 minutes for 115 miles and makes from 10 to 15 stops. Expresses between Boston and Haverhill,

33 miles, take 52 to 59 minutes with only one stop. By the Eastern division the distance from Boston to Portland is the same as the Western and the expresses take 3 hours and 20 minutes, or 200 minutes for 115 miles with 10 to 12 stops and using 65 minutes for the 37 miles between Newburyport and Boston with either one or two stops. On the Southern (Lowell) division the time is even slower, expresses to that point making no stops, use 43 to 45 minutes for the 26 miles covered, and all of their trains stop too long at stations. But it is probable that this time will be shortened as improvements go on and the travellers and baggage men learn to move faster. As it is now popular on many roads to run very fast expresses, with very few stops, making the way trains take the small town folk, to the express stopping points, it may be expected that the Boston & Maine Company will in time send its Portland trains through in 2½ hours or 135 minutes for the 115 miles.

We have thus seen the stage line grow into one of the great railroad systems of the world, and the passenger traffic of the oldest section of the country grow from a few thousands a year into a number equal to half the population of the United States. We have also seen the stage line with \$500,000 of capital replaced by the great railroad system of \$21,-899,000 capital and \$21,741,780.21 of funded debt or a total of \$43,522,885.10 in permanent investment. We have seen the path follow the Indian trail, and the turnpike the path, the stage carrying the people over the highway, and the railroad following the stage route as the evolution has progressed. The speed from 4 miles an hour of the walker, to 16 miles an hour of the post express stage, which in turn grew to 60 miles an hour of the express train. The frequency of the transportation trips grow from one a day to 20 or 30 a day, and most of this has taken place within the life of many people now living, for the regular transportation of people by vehicle has practically all been done within an hundred years.

THE CAUSE OF TRAIN DETENTIONS.

At the meeting of the New York Railroad Club held December 19, 1895, the subject of train detentions was introduced by Mr. C. M. Mendenhall, superintendent of motive power of the Philadelphia, Wilmington & Baltimore Railroad. The following extracts from the discussion present its most interesting features.

Mr. Mendenhall—It occurs to me that the first thing to bring to your attention is the extent of the trouble from train detentions, and, I have concluded that there are four general heads under which it may be divided. I think if any of you will take trouble to work up your records, you will find that approximately 34 per cent of your trains will arrive at their destination late. By late I mean within one minute of the schedule time. That record will vary, from the favorable months, say June, July and August, through to the winter months, which seem to be the most unfavorable. The schedules throughout the country are made so that the locomotives drawing trains can make up more or less of this lost time, and that also will vary with the conditions of the weather, the most being made up in the summer months, and I think the average, covering a pretty large train service, will be found to be in the neighborhood of some eight minutes per train. I will call your attention to this table, which I have put on the blackboard:

CAUSES OF PASSENGER TRAIN DETENTION.	
89.3 p. c.	Arbitrary:
	Traffic.
10.7 p. c. Equip.	Operation.
	Engines, 55 p. c. {
Cars, 45 p. c.	Hot Journals. . . 33 p. c.
	Hot Eccentrics. . . 3 p. c.
	Steam Failures. . . 24 p. c.
	Brake Failures. . . 13 p. c.
	Taking Water. . . 5 p. c.
	Couplers,
	Injectors,
	Steam Heat,
	Markers,
	Miscellaneous. . . 17 p. c.
	100 p. c.
	Hot Journals. . . 48 p. c.
	Brakes. 38 p. c.
	Steam Heat. 4 p. c.
	Parting. 5 p. c.
	Miscellaneous. . . 5 p. c.
	100 p. c.

As to the causes of detentions—they may be divided into arbitrary detentions, those due to traffic, and operating, and those due to the equipment. I am not able to give you any definite measure of the relative detentions of the first three, but I will say that you will probably find 89.3 or 89.5 per cent of the train detentions due to the first three, and those due to failures of the equipment will be approximately 10.5 per cent of the failures to your train service.

Passing on to the failures on account of the equipment, it will be found that 55 per cent are due to locomotive failures, and about 45 per cent to failures in the car service or on the cars. Locomotive failures may be divided into hot journals, eccentrics, etc., steam failures, brake failures, taking water, couplers, injectors, steam heat, headlamps, markers, as the headings which can be classified, and there are hardly enough of the last four which I have mentioned to make it a subject of classification. Then will come the miscellaneous failures, whatever they may be. In the car failures there are hot journals, brakes, steam heat, parting, then the miscellaneous, and I have added at the extreme right about the percentage of failures due to the various parts.

I would say that under arbitrary detentions may be mentioned those due to drawbridges, railroad crossings, grade crossings, conditions of the track due to working, change of track, etc.; and under the head of traffic may come the heavy passenger travel, slow movement of the

people, at times like these, when there are an unusual number traveling; the handling of an unusual amount of express baggage and mail; and under the head of operating may be mentioned the disturbance to the freight movement as delaying passenger trains; and on roads using block signals, neglect, inattention, etc., of operators.

The general means of following up train detentions has been through conductors' reports originally, by which means the operating officers are made aware of the causes for the detention. From that information the engineers' explanations are demanded. When it comes to equipment, the car inspectors and everybody concerned are asked to furnish information to work up the necessary data.

As to the methods adopted to remedy detentions from failures due to locomotive service, I should say that possibly the most important personage is the locomotive inspector in the roundhouse. Then, if the roundhouse organization is such as to be ample for the service required at that point the work will be properly done, and thereby the inspector upheld in his work. After which will come the locomotive runner, who of necessity must do more or less inspecting.

When it comes to the train it would seem that an inspector who looks over the train on its arrival at its destination is almost a necessity, for the reason that boxes which may be running warm can be then detected and marked, so that they may then be attended to before that car has a chance to get on the road again. Then there should be a regular inspection in the yard, with a proper yard force, where any repairs, changes, etc., may be made. Air brakes and the steam heat equipment would also be tested and gone over thoroughly at this point.

Finally, there is, I believe, in practice all over the country the testing of air brakes in the train immediately prior to its departure. So that if the remedies outlined, under the head of remedies, which I have suggested, are followed it would seem that we have taken almost as many precautions as we can to avoid delays.

Mr. Wheatley—It is a very difficult matter to put your finger on one or two things that cause detentions to trains and say that they can be remedied on all roads. Each road has conditions peculiar to itself and to its own service. I know that a very large proportion of train detentions are due to arbitrary causes, for which it would be very difficult to suggest a remedy. Detentions due to traffic are also difficult to control. Detentions due to operating, I think, are very largely matters of discipline, and as the discipline on a road is poor or good its detentions are great or small.

A considerable portion of detentions to trains on single track roads are due to stopping for orders. The remedy for that is to so arrange your dispatching force that the dispatches will not be crowded with work.

Mr. Mendenhall—I might for the interest of locomotive men further analyze that matter of 33 per cent of hot journals.

On locomotives that will be found to be divided into about 48 per cent driving boxes, 30 per cent crank pins, 8 per cent engine truck boxes, and 15 per cent tender truck boxes, and I will state as a very interesting fact that of the total number of hot driving boxes 50 per cent, occur on the right driving box, 25 per cent of the remainder occur on the left driving box, leaving 25 per cent of the whole number of hot driving boxes only occurring on the forward drivers. This refers now to engines with four drivers.

I would like to say that, so far as this chart is concerned, it is the result of a very wide observation, and covers a service throughout the country of about two million locomotive miles per month, and nine and one-third million passenger car miles per month.

Mr. Meade—Mr. Mendenhall spoke in the first place of the percentage of trains that would generally be on time. He said that 34 per cent would be late, that is, as much as a minute. I was looking over the percentage of the trains delayed on the New York Central during the month of November, which is not a very favorable month, and the percentage of passenger trains on time on the whole system was 92 per cent—that is, local trains. Of the through trains 82 per cent made time. I think that is rather a favorable showing. A great many detentions of the through trains are not due at all to the road itself. They are often due to connections being late. Quite a large percentage could be attributed to that. I think every man in the transportation department or operating department who is here to-night was struck with the percentage of detentions which Mr. Mendenhall attributes to the operating of the road, that is, not to the equipment. Mr. Mendenhall's statement covers a very large system, of course, and it is very interesting to find out exactly what percentage is due to that; but I think it struck almost every one that it is a very large percentage to attribute to the traffic, of a road, and not to engine or car failures. I drew up a little schedule very much on the style of Mr. Mendenhall's. First of all—failures due to the engine. I am not in the motive power department.

1. Steam failures, such as arise from bad coal, and the weather, and inexperienced or bad firemen.

2. Accidents from breakages, such as crank-pin or journals, slipped eccentrics, injectors, foaming, various mechanical matters of that kind.

The second division—failures due to equipment, say hot journals, air and steam apparatus and various matters of that kind.

3. Atmospheric conditions, such as bad rail, head winds, snow and matters of that kind, which are practically arbitrary, according to Mr. Mendenhall's scheme.

4. The operation; first, terminal work, switching, loading passengers, baggage express, mail, and delays by other trains, and all delays that are incident to a large terminal. Sixth, station and water stops, loading passengers and freight. Seventh, what might be classed as handicap, such as too fast schedule for train, extra stops added to its schedule, or overloaded trains, which is one of the most frequent causes of detention.

8. Outside causes, arbitrary, such as drawbridges, and detentions at connections.

Mr. Molineux—I noticed some time ago at one station on the Pennsylvania road this notice: "Passengers will please enter the car from the rear platform." If that could be done more throughout the passenger service it would certainly shorten the stops at the station. If the

passengers leaving the car go out through the front door, and those boarding the car enter through the rear door, you could carry on both operations at one time without crowding.

Mr. Wattson—Mr. President, the greatest bugbear to a railroad superintendent and his superior officers in the operating department is train detentions, and I daresay that many superintendents in this country, if asked what percentage of the detentions were due to engines and equipment, would say at least 80 per cent. I have never known a superintendent who did not think that it was either the power or the car equipment that was at fault for most of his troubles. I am very much surprised at the classification of detentions which we have had presented before us to-night. It may be correct. I cannot dispute it, because I have never carefully classified train detentions, although I have prepared frequently general averages of detentions of trains on my division, for the purpose of comparison, to see how the detentions of one month compare with those of another month in the same year. I submit, however, that on a railroad which had no connections, or which did not wait for delayed connections, that if there were no motive power failures, there would be no difficulty in running 95 per cent of the trains on time, because I feel that there are no other classes of detention but can be largely overcome by good discipline. But when it comes to dealing with engines and cars, which have so many different factors in the list of possible causes of detentions which discipline cannot control, the question as to remedy broadens very materially. Sometimes the trouble is due to faulty construction by the manufacturer—poor machine always developing weakness. Sometimes the purchasing agent buys poor fuel or too cheap supplies. Sometimes engines must necessarily be kept out of the shops too long, etc. But leaving the engine and car failures out of consideration, the superintendent can control about everything else. In figuring the runs of his trains, he will make his schedules to provide for the maximum traffic which is to be handled on each of the respective runs, and he will discipline his conductors so that they will know better than to wait for a belated passenger coming down the hill.

As to delay caused by handling express, if you allow an express company to bring in all the business that can be gathered up at any town and load on one train, why of course that train will be late. But if you have the express company and the conductors to understand that after the passengers are on the train and the baggage is off that the train starts, they will so distribute their business that there will be very little detention from this cause.

My object in speaking of the possibility of running a road not having any connections on time was for the purpose of referring to what might be termed progressive or accumulative delays—that is, after the first detention to the train the delays generally increase as it proceeds—if not directly to the particular train, to some other train affected by its movement. Delays on account of waiting for connections are the most troublesome, from the fact that the train dispatcher cannot figure accurately what the detention will amount to—if he attempts to help other trains on the reported detention of the connection he will frequently find that the detention is greater or less than reported, and as a result things are mixed. If he waits till the connection arrives, he has so many orders to give at once that more delay follows in transmitting and getting them complete to trains. Also, when trains get behind time, a big effort is made by the engineer to recover, and these efforts often result in hot boxes, breakages of machinery or accident. Seldom does a train on time get into trouble.

Our chief detentions are from the operating. Our freight trains get in the way, and of those detentions I believe that 90 per cent are on account of the failure of the men in charge of the trains. We have occasionally a little detention from a dilatory conductor. We stir him up and he gets along all right until the next time. We do not let the express goods detain a train more than once. The next time a train comes along to that station it won't be detained.

A short time ago I rode on one of our trunk lines running into Buffalo, and over a division that had a good many freight trains. We were blocked about twenty minutes with a slight freight wreck, and when I retired at night were about thirty minutes late. When we arrived at Buffalo I asked the conductor, who passed through, whom I had known for several years, how we were, and he said, "On time." I said, "How is that? When I went to bed you were forty minutes late, and you hardly ever make up anything on this division." He said, "Under the old superintendent we would not have done it; we would have come into Buffalo an hour and a quarter late. We have passed twenty freight trains since you went to bed. Formerly we would have lost that time; every freight train would have stolen from our time. When the new superintendent came in he called all passenger and freight conductors before him and he said: 'I notice that there is only one class of trains on this road, and that is second class. Now I am going to make it a penalty of one day suspension for every minute you delay a passenger train.' The freight conductors said, 'We will never get your freight trains over the road.' Now, the freight men are swearing by this new superintendent. They are getting over the road, they say better than ever before, and the passenger trains are all getting over the road on time." I think a great many passenger trains, especially on single track, are delayed from freight trains pulling in two or three minutes ahead of the passenger train's time, and the passenger train is unable to make the time up.

Mr. Hill—In nine cases out of ten where the engineer's trip report has a detention blank on the back of it, nothing is ever done unless there is a case of suspension on hand. The superintendent of motive power does not compile that table and figure on the thing as the superintendent does. What the officers of the road ought to get at is the truth, and then they can take these matters up one at a time and rectify them. On the government railroads of New South Wales they have a system that it seems to me would be very easily inaugurated here. They have special detention slips with blanks. It is a graphic thing; there is an outline of the road, a blank line for making the detention mark opposite every station or between stations. That is made out at the end of the trip by the engineer before his engine is detached from the train, and

the conductor has to go to that engine and sign that slip. There can be no lying between the two departments. They must settle right there before they end their trip what has delayed that train. Both men sign the same report and it goes to the general officer.

PRESERVATION OF LAKE LEVELS.

The attention of congress has been recently called to the subject of the preservation of the level of the water in the great lakes and a resolution is now in the hands of the rivers and harbors committee directing the secretary of war to give an estimate of the cost of making surveys with a view of the construction of dams, jetties or locks to prevent the outflow of water. This committee passed the matter on to a sub-committee to make a report, of which the following is the substance:

"It is a fact well established that for years there has been a steady subsidence in the waters of the great lakes until their present level is from four to five inches below the normal height. Navigation is already seriously hindered by the lowering of the lake levels, which causes a great sacrifice in carrying capacity by the vessels engaged in freight traffic. The raising and conserving of the water level of the great lakes is a matter of vast importance, indeed of vital necessity to the internal commerce of the nation. The plan of accomplishing this above suggestion has the support of very distinguished engineers, and in view of the magnitude of the interests involved, your sub-committee would respectfully recommend that the resolution be favorably reported to the house.

Your sub-committee having also considered the papers on this general subject submitted by George Y. Wisner, civil engineer of Detroit, and Thomas T. Johnson, civil engineer of Chicago, before the International Deep Waterways Association at its convention in Cleveland, in September last, and deeming them to be of great value for the information and suggestions they contain would respectfully recommend that the committee on rivers and harbors incorporate these papers in its report on the resolution."

The sub-committee also submitted as a part of its report the following letter from Major W. L. Marshall, corps of engineers, U. S. A., of Chicago.

"As I thoroughly believe that the control of the levels of the great lakes is the most necessary and important question that now arises and will soon confront the corps of engineers, demanding almost immediate solution, I am firmly of the opinion that it is absolutely essential that the war department embark in a thorough investigation of the physics and hydraulics of the great lakes and their outlets including continuous and careful measurements of currents, discharges and slopes, in connection with gage readings and accurate surveys, especially of outlets, artificial channels, etc. To control the levels of the great lakes, then there must be necessarily extensive damming by wing dams of the outlets excavated, when the excavations are so extensive as to modify channels to the extent demanded, or else single dams of considerable height at the foot of the slopes affected. To control the level of Lake Superior there must be a dam at the rapids at Sault Ste Marie. To control the slopes between Huron and Erie (improvements contemplated being made) there may be required extensive wing dams in St. Clair and Detroit rivers, depending on the lengths and extent of the excavations. To control the levels of Erie there may be required dams in Niagara river, which may also control the levels of Michigan and Huron."

Important Car Heating Decision.

In the circuit court of the United States for the northern district of New York, Judge Coxe handed down a decision on the 20th of January, 1896, in the case of the Consolidated Car-Heating Company vs. the Martin Anti-Fire Car-Heating Company, for infringement for the Sewall coupler patent, in favor of the former company. Judge Coxe holds that the patent on the Sewall coupler is substantially a pioneer patent, and its claims are broadly sustained by the court. The opinion says that "the practical identity of the infringing couplers is shown by the fact that they will couple and uncouple as readily with the Sewall coupler as with themselves."

In celebration of its fiftieth anniversary the publishers of the Buffalo Express issued an exact reprint of the Morning Express of January 15, 1846. At that date only one train of cars, each day, left Buffalo for Albany and New York, and but one train a day ran between Buffalo and Niagara Falls. Freight rates between Buffalo and Troy, at that period, were \$1.15 per 100 pounds for first-class, \$1 second class, and 66 cents third class. For carrying pianofortes, carriages and sleighs a rate of 4 cents per mile was charged.

A Proposed Technical Club for Chicago.

On November 14, 1895, at an informal meeting of a number of gentlemen who are interested in the formation of a technical club in Chicago, it was proposed that circulars should be sent out to engineers and others with a view of ascertaining the feeling in regard to establishing a social and technical club upon somewhat the same lines as those of the Engineers' Club of New York, the membership to be composed of engineers, architects, railway officials, and representatives of allied interests. It was proposed that all the usual accommodations of a social club should be provided, including a restaurant, and a rather large number of sleeping rooms; and to maintain them in a thoroughly comfortable and serviceable manner on a low basis of dues. It is anticipated that the non-resident membership will be large and a special feature of the club. It is thought that if one hundred and fifty or more favorable replies to the circular letter sent out are received, the organization can safely be formed. It has been suggested that charter members pay \$50, this amount to cover

initiation and one year's dues, and that others joining the club be required to pay this amount for initiation only; that the annual dues be \$30 for resident and \$20 for non-resident members; and that the club be started in leased quarters within the central business portion of the city. On Friday of last week a meeting was called of the gentlemen who had signified their desire to assist in organizing such a club, and 153 of these acceptances were opened. The number with which it was considered could be safely started was put at one hundred and fifty. Messrs. C. E. Billin, John W. Cloud and George A. Lederle were appointed a committee on organization, and Messrs. A. Sarge, Jr., H. F. J. Porter and J. P. Lewis were appointed to report upon quarters.

A NEW INTERLOCKING PLANT.

The Union Switch and Signal Co., of Swissvale, Pa., has completed one of the largest interlocking plants installed in Chicago for several years. It is located at the crossing of the Chicago & Northern Pacific and the Chicago & Western Indiana railroads and has 21 levers for 32 switches, 2 movable point frogs and 2 locks; 15 levers for 34 facing point locks and 25 levers for 27 signals. The total number of working levers is 61 and with 11 spare spaces the machine has a 72-lever frame. The plant was completed before the first of the year and went into service Sunday, January 19. The lead out is the hexagon rocker shaft type which is put in under patents by this company. There are but two selectors on the plant and facing point locks are used instead of switch and lock movements even for switches near the tower. The derails also are locked with facing point locks. The plan shows care in laying out the work so as not to overload levers and yet the distribution does not employ an unnecessarily large number of them. The tower is an excellent piece of work and is arranged to give additional space under the roof by having the ceiling follow the roof to give two feet additional head room. The tower is finished in hard pine, has a steel roof and outside stairs. The most remarkable feature about the contract was the fact that it was completed on time and without a cent of extra charge. The work was done under the direction of Mr. V. Spicer of the Union Switch and Signal Co. and Mr. F. E. Paradis Chief Engineer of the Chicago & Northern Pacific, had direct charge of the plans and construction. A gentleman who has examined a large number of interlocking plants near Chicago reports that the workmanship and engineering of this contract are the best he has seen, which fact is highly creditable to the contractors and to the chief engineer.

More Air Brake Patent Litigation.

The Westinghouse Air Brake Co. has applied to the United States supreme court for a writ of certiorari in the case with the Boyden Air Brake Co., and the hearing has been granted.

As an indication of the heavy freight traffic on the Chesapeake & Ohio, a dispatch from Richmond states that in a period of twenty-four hours recently there passed over the line 207 freight trains, consisting of 5,213 loaded and 2,598 empty cars. The loaded eastbound cars carried chiefly coal and export grain, flour, etc. The coal loaded at the mines on the Chesapeake & Ohio and transported both east and west-bound since January 1 has averaged over 700 cars per day.

PATENTS ON RAILWAY APPLIANCES.

[The following list of patents granted for inventions relative to railroad appliances for the week ending January 28, is reported especially for the Railway Review, by Chas. L. Sturtevant, patent attorney, Washington, D. C., from whom printed copies can be obtained for 15 cents each.]

Boucher, Pierre N., Sherbrooke, Canada, roller bearing for railway car axles, 553,773.

Boyd, James S., Greenville, Texas, car coupling, 553,505, 553,506.

Ewart, Philo C., Cincinnati, Ohio, assignor of one-half to C. A. Barnard, Cleveland, Ohio, car coupling, 553,706.

Herstrom, Martin, and W. A. Grandjean, Denver, Colo., car replacer, 553,818.

Hitt, Adrian, Jersey City, N. J., hand car, 553,617.

Innes, Robert H., San Antonio, Texas, automatic repeating railway signal, 553,733.

Langen, Eugen, Cologne, Germany, construction and connection of railway cars and locomotives, 553,756.

Larkin, John M., Memphis, Tenn., car coupling, 553,587.

Lighthall, Almerin, H., New York, railway system, 553,622.

Maurer, George, Hilldale, Pa., lubricator for coal cars, 553,684.

McKaig, Elthera P., Richmond Hill, N. Y., pilot for railway cars, 553,787.

Mitchell, James C., Lancaster, N. H., assignor of three-fourths to H. R. and T. M. West, and D. McDonnell, Lewiston, Me., swivel or fifth wheel for railway vehicles, 553,537.

Noyes, Henry F., Elgin, Ill., air brake, 553,569.

Platz, Charles, New York, N. Y., railway spike, 553,626.

Reynolds, George A., Utica, N. Y., assignor to Reynolds Railway Gate Company, of Maine automatic railway gate, 553,541.

Simons, James E., Pittsburgh, drop door for cars, 553,792.

Walters, Frank A., Denver, Colo., automatic coal recording system for railways, 553,632.

Gould Coupler Company, New York and Depew, N. Y., car buffers, platforms, and couplings, and parts thereof, 27,724.

Sternbergh & Son, J. H. Reading, Pa., railway track bolts, 27,702.

PERSONAL.

Mr. John R. Young, receiver of the Atlantic Short Line has been made president of the same company.

Mr. William G. Mather has been elected president of the Ishpeming & Lake Superior Railroad, which is to operate a line between Marquette and Ishpeming, Mich.

Mr. George A. Morton of New York has been elected president of American Association of General Baggage Agents.

Mr. J. N. Sutherland of the Ontario freight department of the Canadian Pacific, succeeds Mr. E. Tiffin as general freight agent of the Atlantic division of that road.

Mr. John Burton, general freight agent of the Grand Trunk, has been permanently appointed to represent that system on the board of managers of the Joint Traffic Association.

On January 22 Mr. E. St. John assumed the duties of vice president and general manager of the Seaboard Air Line, his office heretofore having been that of vice president alone.

Maj. G. W. F. Harper, at present president and treasurer of the Chester & Lenoir has been made receiver of that road for the purpose of effecting a reorganization of the property.

Mr. John C. Heitbahn, local agent of the St. Paul at La Crosse, has been appointed to succeed Mr. H. T. Milliken as local freight agent at Chicago. He will assume his duties on Feb. 1.

Mr. Thomas L. Greene of New York City, has been sent to the Pacific coast by the reorganization committee of the Oregon Improvement Co., to make a report on the company's property.

Mr. James G. Cantrell has been appointed soliciting freight and passenger agent of the Seaboard Air Line, vice Mr. W. H. Knox, resigned. His headquarters will be at Nashville, Tenn.

Mr. I. W. Blassingame, live stock agent of the Missouri, Kansas & Texas is appointed live stock agent for the Choctaw, Oklahoma & Gulf Railroad, with headquarters at South McAlester.

Mr. F. M. Snively is appointed city passenger and ticket agent of the Chicago & Northwestern at Milwaukee, Wis., with office at 102 Wisconsin street, vice Mr. F. W. Hall, appointment effective January 30.

Mr. W. S. Kinnear has been appointed assistant chief engineer of the Michigan Central. He was formerly connected with the road, but has more recently been engineer of the Toronto, Hamilton & Buffalo.

Mr. H. A. Wood, formerly with the Mexican Central Railway but for some time past general superintendent of the Intercoastal Railway Co., has resigned to come to the United States and engage in business.

Mr. John C. Winder, who since 1890 has been general manager of the Seaboard Air Line, has resigned that position, and the duties of general manager will be performed by Mr. E. St. John, now vice president.

Mr. W. A. Eldredge has been appointed freight claim agent of the southern lines of the Illinois Central and will have charge of that department of the Yazoo & Mississippi Valley road which will, on Feb. 1, be moved from Memphis to New Orleans.

Mr. Robert Kirkland has been appointed freight claim agent of the Illinois Central Railroad Company (northern and western lines) taking effect February 1. All communications relating to freight claims should on and after that date be addressed to Mr. Kirkland.

Mr. Chas. C. Cameron has accepted the position of claim agent of the Chesapeake, Ohio & Southwestern with headquarters at Louisville, Ky. Mr. Cameron has for some time been chief clerk in the claim office of the Illinois Central road and leaves that office with the good wishes of all.

Mr. J. H. Sample has been temporarily released from the duties of general superintendent of the Northern Ohio and the authority of Mr. D. S. Hill as general superintendent and Mr. G. T. Jarvis as assistant general superintendent of the Lake Erie & Western Railway has been extended to include the Northern Ohio.

An official circular announces that Mr. J. H. Barrett having tendered his resignation as general superintendent of the Ohio Southern, and same having been accepted, taking effect February 1, 1896, Mr. J. H. Sample is hereby appointed acting general superintendent and will assume duties as such on that date. Officers and employees will obey his orders accordingly.

It is announced that the jurisdiction of Mr. Leonard Goodwin, assistant trainmaster, Lehigh division of the Lehigh Valley Railroad is extended over the Easton & Amboy Railroad. He will attend to such duties as may be assigned to him by the superintendent and the train masters. His office for the present will be at Slatington as heretofore.

Mr. Donald M. Philbin has resigned as general manager of the Duluth, Mesaba & Northern Railroad and will leave the employ of the road on the 25th inst. His relations with the road, both personal and official, have been the pleasantest, and the remaining officials regret the loss of his services. It is stated that J. W. Kreitter the able assistant of Mr. Philbin will step in as acting general manager.

Mr. Edward R. Bacon, president of the Baltimore & Ohio Southwestern, at a meeting of the directors of the Baltimore & Ohio road held in Baltimore on January 24, was elected to fill the vacancy in the board caused by the retirement of Mr. George C. Jenkins. Mr. Bacon represents the New York interest in the property, and was nominated by General Louis Fitzgerald of the Mercantile Trust Company.

Hon. John K. Cowen, general counsel of the Baltimore & Ohio Railroad Company, and representative in congress

from the fourth Maryland district, was on January 24 elected president of the Baltimore & Ohio Railroad Company. Mr. Cowen was decided on as a compromise between the factions in the board favoring Major Alexander Shaw and Second Vice President Thomas M. King. He was the choice of the New York and Garrett interests, their votes being cast solidly for him. Mr. Cowen at first was adverse to assuming the presidency of the system, but finally yielded. Mr. Cowen was born October 28, 1844, at Millersburg, Holmes county, O. He was educated in the public schools, at the Academy of Fredericksburg, and the one at Hayesville, O. He was graduated from Princeton College in the class of 1866, and studied in the law, school at Ann Arbor. He was admitted to the bar of Ohio in 1868, and began practice at Mansfield the same year. In February, 1872, he removed to Baltimore, and has been practicing law there for many years.

Mr. W. K. Gillett, the popular general auditor of the Atchison, Topeka & Santa Fe Railway Company, has resigned. He will not leave the company's service, however, until May 1, as the managers want him to remain until the change in books and accounts, made necessary by the reorganization, has been completed. About a month ago Mr. Gillett was re-elected general auditor of the company by the new board of directors, and his resignation so soon thereafter is something of a surprise. Mr. Gillett says the principal reason for his resignation is a desire to take care of his own private interests. He is largely interested in Cripple Creek mining property, and is one of the largest stockholders in the Cripple Creek Railroad. He will not go West, however, to take direct charge of those properties, but will make his headquarters in this city. Mr. Gillett is considered one of the ablest and most experienced auditors and accountants in the United States, and is more widely known than any other man in the country holding a similar position. He has been with the Santa Fe Company since Feb. 1, 1890.

Mr. E. Kolben, of the Oerlikon Machine Works, in Switzerland, has written an essay on worm or tangent gearing that should be translated into English. There is a great want of information in respect to such gearing, not in its theory, but in constructive features, and especially its operating conditions. The essay above mentioned contains the result of some experiments, showing a loss of only 13 per cent by a brake test with tangent gearing, which is no doubt correct. The test was made under a resistance of 21 horse power, and a speed of 1,500 revolutions per minute for the screw. These experiments were made by Prof. Stodola at the Zurich Polytechnic with gearing made at the Gerlikon Works. The wheel was of bronze, and the pinion or screw of steel. We note here in some cases pinions made of bronze, which is expensive and useless. The tenacity of material is required in the wheel and not in the screw. The latter does not break and in conforming by wear it is the wheel that should be worn, consequently it should be made of softer material; cast iron or steel are better for the screws.

RAILWAY NEWS.

Atchison, Topeka & Santa Fe.—It is stated that the Atchison executive committee has decided to adopt the recommendation of the officers in respect to publication of statement of earnings which will hereafter be issued monthly and will be actual figures. These statements will be issued as promptly as possible and will include the business of the following lines which now constitute the Atchison system; Atchison, Topeka & Santa Fe; Gulf, Colorado & Santa Fe; Southern California; Mexico & Arizona, and Sonora. Statement of December earnings will be issued very shortly under the old plan and will include reports furnished by the receivers, after which the new method will go into effect. The earnings for each month will probably be issued about the 25th of the following month.

Chester & Lenoir.—The Chester & Lenoir road, which is a narrow gauge line, 110 miles in length, running between Chester, S. C., and Lenoir, N. C., and was a part of the Richmond & Danville before the reorganization, and which since that time has been trying to maintain a separate existence, has now been put into the hands of a receiver. It is stated, however, that the situation is not so bad as the naked statement would imply. The road is paying its interest, etc., but a holder of four bonds, \$2,000 in all, refuses to accept the reorganization plan of the very large majority, in numbers and interests, of the bondholders, and has started foreclosure proceedings; and the bondholders who have deposited their bonds, some \$220,000 out of a total of \$250,000, and who have been acting in harmony with the stockholders, protect themselves by taking the initiative. It is believed that nearly all the bonds not yet deposited will come in, their holders have merely deferred or neglected the matter. It is claimed there is no freezing out of stockholders or defrauding creditors in the proceedings. Maj. G. W. F. Harper, president of the road, has been appointed receiver, and it is expected that he will administer the receivership with the same skill, ability, and regard for the interests of the public and the bondholders and stockholders that has marked his presidency. The organization will be pushed through, and it contemplates building the 10 miles between Hickory & Newton, N. C., where now is used a third rail over the Western North Carolina (Southern) railway; also further improvement of the property, at its junction points.

Chicago & West Michigan.—Reports show that Mr. Thomas McGuire, of Grand Rapids, Mich., general traffic agent of the Chicago & West Michigan Railway, was recently in Green Bay, Wis., in consultation with the officials of the Green Bay, Winona & St. Paul road. The West Michigan road, which is a strong competitor of the Ann Arbor road, is desirous of making better and shorter western traffic connections. It is thought to be the purpose of the company to run a line of winter steamers across Lake Michigan, either from Grand Haven to Manistee, or some point on the west shore, Keweenaw preferred. However, the Keweenaw, Green Bay & Western road, already has a traffic arrangement with the Ann Arbor road, so that it is not certain that anything will be done in that direction. The officials of the West Michigan, however, say nothing

further than that better western traffic connections are being sought.

Chicago, Peoria & St. Louis.—The reorganization of the Chicago, Peoria & St. Louis R. was completed January 30. The new road will be known as the Chicago, Peoria & St. Louis R. of Illinois. The first board of directors is: Henry W. Putnam, Jr., New York City; Daniel B. Hatch, New York City; Charles D. Bosworth, of Springfield, Ill.; Charles D. Moyer, Chicago; Charles F. Dean, New York City; Charles E. Jackson, Middletown, Conn.; John W. Houston, New York City; James Miles, Chicago; Silas H. Strawn, Chicago; Edward S. Whitney, Chicago; Wm. M. Raymond, Chicago. The capital stock is to be \$5,000,000, of which \$2,500,000 is to be non-cumulative 5 per cent preferred stock and \$2,500,000 common stock.

Cincinnati, Hamilton & Dayton—Indiana, Decatur & Western.—On February 1 the Cincinnati, Hamilton & Dayton syndicate will take control of the Indiana, Decatur & Western. Mr. R. B. F. Peirce will retire, and the policy of the road will be dictated by Mr. Wm. Green, general manager of the Cincinnati, Hamilton & Dayton, whose authority will be extended over the Indiana, Decatur & Western. Mr. John Lazarus will continue as general freight and passenger agent until May 1, subject to the orders of the freight traffic manager, McLeod; and general passenger agent, Edwards. George Graves, the present superintendent, will remain in that position.

Florida East Coast.—The jurisdiction of the officers of the Florida East Coast Railway is hereby extended over the Florida East Coast Steamship Line. Separate reports and remittances should be made on account of the Steamship Line.

Georgia & Alabama—Abbeville & Waycross.—General J. A. Fitzgerald, manager of the new Grand Army Colony in south Georgia, has closed the deal with the Georgia & Alabama road, whereby the Abbeville & Waycross road—24 miles in length—passes into the possession of the first named company. Four hundred men are at work upon the line and expect to complete it into Fitzgerald within the next week. A large force is already working on a line from Tifton, and that road will reach Fitzgerald within a few days. This will give Fitzgerald, the new colony city, which has been founded by old soldiers, two new railroads. There are 7,000 people, seven hotels and a bank in the place.

Lima Northern.—It is reported that the progress of the Lima Northern, Calvin Brice's new railroad, has been most satisfactory. The grading is very nearly completed between Napoleon and Lima, only a few miles yet to finish, and more than that the track is laid to Malinta, where connections have been made with the Clover Leaf. The company has also commenced the construction of a telegraph line along the proposed route, which it is expected will be completed to Napoleon by next week, when an office will be established at once. Stone masons have commenced their work on the Maumee river piers, which are to be ready for bridge workers by the first of March.

Manitoba & Northwestern Railway of Canada.—On this railway no extensions have been built during the past year. The only permanent betterments have been the replacing of a large number of cedar box culverts for pile culverts which were built during construction of the road, and which required repairs heavy enough to warrant their removal. The roundhouses at Portage la Prairie and Minnidos have had an extensive overhauling and have been put into first class order. The Manitoba & Northwestern Railway Employees Library Association has built a comfortable building in Portage for the employees. The building contains dinner and reading room, wash room, and two bath rooms furnished with hot and cold water. The company presented the association with a neat little building at Minnidos, which has also been fitted up as a reading room and bath room, etc., for the employees at that point.

Metropolitan "L."—The Metropolitan "L" has begun the construction of a new feeder to its main line and branches now in operation, which will be known as the Douglas Park line and will terminate on the south side of the park. Its divergence from the main line begins at Paulina street and thence it is to be constructed to 20th street, and from that point due west to the park. The extension is in process of construction, no less than 500 men being already engaged in setting up the supports and building the superstructure of the new branch. The company has 12 miles of aerial transportation over on the west side and by June 1, 1896, will have 4½ miles added for the accommodation of west riders who wish to get quickly to the south side.

Nevada Southern.—A deed has been placed on record at San Bernardino, Cal., conveying the Nevada Southern to Mayor Carlson of San Diego, as trustee. The deed was signed by Mr. Isaac E. Blake, president of the said road, at New York on the 9th of the present month. Among the many rumors regarding this action the one most generally accepted is that the Southern Pacific is behind the deal, and will extend its system by this line from Utah to San Diego. The road is 40 miles long, and runs from Blake Station, just west of the Needles, on the Atlantic and Pacific, northward to Manvel, on a direct line towards Salt Lake.

New England.—Statements have been made to the effect that plans are being made to double track the New England road from Bristol west through Waterbury to Hopewell Junction, thus making it a great trunk line for freight. It is said that a railroad contractor has received a letter from President Clark asking him to estimate the cost of the work. It is also stated that President Clark is trying to get control of a route through New York state which will shorten the route to Chicago by 117 miles.

Ottawa, Arnprior & Parry Sound.—The contract for the unfinished portion of road from the present western terminus of the Ottawa, Arnprior & Parry Sound R., 162 miles west of Ottawa, to Emsdale, on the Northern & Northwestern R., the present eastern terminus of the Parry Sound Colonization R., has been awarded to E. F. Fauquier of Toronto. Surveys have been completed and the work of building camps and getting in supplies will begin at once. With the exception of 15 miles at the western end the line passes through a wilderness, 25 miles of which is through the Algonquin National Park; the greater portion of the work is excessively heavy and is to be completed during the present year.

St. Louis, Cape Girardeau & Ft. Smith.—The following official notice, signed by Mr. Louis Houck, receiver, has been received: "All parties having claims against the St. Louis, Cape Girardeau & Ft. Smith R. Co., as well as detached coupons against said company, will please take notice that at the January term of the circuit court of Cape Girardeau county, state of Missouri, the following order was entered of record, viz: 'Leo Doyle, trustee, plaintiff, vs. The St. Louis, Cape Girardeau & Ft. Smith R. Co., The Mercantile Trust Co. of New York, and Edward Hidden, trustee, defendants. Now comes the plaintiff by R. B. Oliver his attorney, and the defendants, St. Louis, Cape Girardeau & Ft. Smith R. Co. by Mr. Smith its attorney, and the Mercantile Trust Co. by Eleonious Smith its attorney, and Edward Hidden by A. N. Edwards his attorney, and the court having seen and heard the motion of plaintiff asking this court to fix the time within which all claims, including holders of detached coupons against the St. Louis, Cape Girardeau & Ft. Smith R. Co. shall be presented to this court for adjudication and the court now being fully advised thereof, doth order and adjudge that all parties to which the St. Louis, Cape Girardeau & Ft. Smith R. Co. are indebted, in any way, or on any account, including the holders of detached coupons, shall, on or before the 15th day of June next, present and file the same in this court, for proof and adjustment, and if not presented and filed on or before said 15th day of June next, the same shall be forever barred. And it is further ordered by the court that a copy of this order be published, once a week, for four weeks, in some newspaper published in the cities of New York, St. Louis and Cape Girardeau, and that the first insertion of said notice to be made within 20 days, from and after the 10th day of January, 1896. And it is further ordered by the court that a printed copy of this order be posted in each of the depots belonging to the St. Louis, Cape Girardeau & Ft. Smith R. Co. by the receiver of this court, and within 20 days after the 10th day of January, 1896.'"

St. Louis, Avoyelles & Southwestern.—About 8½ miles of track is now laid on the St. Louis, Avoyelles & Southwestern road, or that part of the line between Bunkie and Cottonport, and freight trains are now running between these two points. Tracklaying is in progress to Simmesport, to which point grading has been completed for some time. Ira W. Sylvester is chief engineer and superintendent, Bunkie, La.

Southern Railway.—Dispatches from Raleigh, N. C., say, "For the first time since it was chartered, fifty years ago, the North Carolina Railroad, now a part of the Southern Railway system, will pay taxes in 1896. This valuable property, capitalized at \$4,000,000, and extending for nearly 300 miles through the best portions of the state (by reason of a provision in the road's charter to the effect that it should not be taxed until the dividends exceeded 6 per cent) has escaped taxation until now. But last week the board of directors declared an annual dividend of 6½ per cent, 3 percent payable February 10 and 3½ per cent payable August 10, and so the whole property goes on the tax list. This result was foreseen when the recent lease of the property to the Southern was made for ninety-nine years—in fact, it was one of the conditions of that lease, and the chief incentive which made the governor and the directors on the part of the state (which owns a majority of the stock) advocate the lease and effect it."

West Virginia Central & Pittsburgh.—At the shops of the West Virginia Central & Pittsburgh at Elkins, in addition to the repairs and replacement of equipment, there have been built during the year just passed 45 new coal and coke cars, and the company expect to erect 10 or 12 each month during the current year. The company has lately added to its equipment three 70 ton locomotives, making a total of 32 locomotives owned. Those lately purchased are of the Baldwin make consolidation pattern. The coal and lumber business of the road is very active, more lumber moving than is usual at this season of the year.

NEW ROADS AND PROJECTS.

Alabama.—It is said that citizens of Pine Apple, Ala., have offered to build a line to that town from the nearest point on the Louisville & Nashville which would be a distance of about 25 miles, if the Louisville & Nashville will consent to operate it. The proposition is under consideration by the authorities of the company.

Iowa.—A new railroad company was organized at Dubuque, Ia., during the present week, under the name of Dubuque & Pacific R. Co., to build a railroad west from Dubuque to a connection with the Chicago & Northwestern. The new line will be about 100 miles in length and will probably connect with the Chicago & Northwestern at a point near Toledo, Tama county. The directory chosen is as follows: Charles T. Hancock, B. J. O'Neil, W. H. Torbert, J. Kauffman, A. N. Heeb, J. W. Coates, J. W. Conchar, George Kiesel. Officers: Charles T. Hancock, president; B. J. O'Neil vice president; W. W. Bonson, secretary; F. A. Rumpf, treasurer.

Michigan.—It is said that the right of way for a new line between the city limits of Ann Arbor and Whitmore Lake has now been practically secured by the Ann Arbor, and that work will begin as soon as frost is out of the ground. The new line is to be 7½ miles in length, and besides shortening the road 2½ miles will reduce the grade 90 ft. By this change Emory will be off the Ann Arbor, and the road will extend through Northfield instead. It is also said that the company has several other changes in prospect which will improve the course of the road.

Mr. J. W. Boynton, president of the Central Michigan R. Co., is quoted as saying that the Muskegon & Fostoria R., by way of Hillsdale, Branch, Calhoun, Barry, Kent and Ottawa counties, is a sure go, the right of way having been secured through the counties stated and part of the way through the territory in Ohio to the southern terminal. It is said that Mr. Boynton has much of the right of way represented in deeds, and the project has the approval of the railroad commissioner. It is the intention to build the shops at Muskegon, Mich., and one of the marine lines entering there has agreed to organize a car ferry system to attend to the lake part of the business. It is also stated that the bonds have been placed conditionally upon the securing of all the right of way.

The people of Marion and vicinity are rejoicing over the prospects of another railroad, a branch of the Flint & Pere Marquette, from Clare via Harrison. The road is constructed and in operation to a point 9 miles south and east of here, and pushing this way. The right of way through the townships of Winterfield and Marion will be donated, and also railway ties for the construction of the road. From here it is expected the road will run north to McBain and Lake City.

Advices from Bay City, Mich., say that the Michigan Central will build a siding to the Monitor coal mine in the spring, and will take the entire output of the mine, providing the company will successfully compete with the Ohio companies, from whom coal for fuel on the railroad is now obtained.

Minnesota.—The North Dakota & Minnesota Central R. Co. has filed articles of incorporation at St. Paul, to build a line from a point in North Dakota on the Missouri river to Lake Superior in Minnesota. The headquarters of the company to be at McIntosh, Polk county. It is the intention of the incorporators to operate the road in competition with the Great Northern and the Northern Pacific companies for the purpose of securing to the farmers a less rate on freight from North Dakota and northwestern Minnesota to Duluth. The incorporators are Robert Ray, Esten O. Estenson, Elias Steenerson, Charles T. Lannon, John D. Knuteson, John P. Johnson, Thomas Lawrence, Ole Sannes, and Anton Jensen. The company will have a capital stock of \$100,000, with power to increase it to \$5,000,000.

Missouri.—A project for another standard gage railroad to form almost an air line from Kansas City to the Gulf being formulated in Missouri, and is said to be backed by large capital. The corporation is to be composed of the Missouri Midland R. Co. and the Missouri Consolidated Coal & Mining Co. The Missouri Midland R. Co. is a corporation formed for the purpose of building a standard gage line of railroad from Marshall, Mo., through Sedalia, Springfield, and down to the gulf at Galveston. The proposed route is almost an air line and lies through excellent agricultural, mineral and coal country. The company has ample capital and is ready now to begin work. The Missouri Consolidated Coal & Mining Co. has acquired more than 11,000 acres of mineral land through which the railway is to pass, and proposes to operate the system of mines in connection with the railway enterprise.

North Dakota.—The farmers' road, which was projected and surveyed last summer, has filed articles of incorporation in North Dakota to build a railroad from Drayton northwest through Pembina, Cavalier, Towner, Rolette, Bottineau and Ward counties to a point near Portal, about 25½ miles. It is estimated that the cost of construction will be \$4,000 per mile. Considerable grading has already been done. A meeting of the stockholders will be held at Drayton, N.D., March 18 to consider the following propositions: Increase the capital stock of the company from \$100,000 to not less than \$300,000 nor more than \$1,000,000, shares to be of \$100 each; amend the articles of incorporation so that the purpose of the company as set forth shall include the extension, building and operation of the railroad into and across the state of Minnesota and within the state of Wisconsin. Incorporators are David W. Hines, Alphas Adams, Wm. Hines, Jabez W. Hines and Napoleon Nault. Capital stock, \$100,000.

Ohio.—The new enterprise known as the Central Ohio & Pennsylvania Co. is interested in large stone quarry properties in Vienna and Brookfield, Trumbull county, and it will connect them with the Erie R. of Sharon by building a branch line part of the distance and using an old railroad into Brookfield the rest of the way. With the exception of C. J. Daly of Sharon, and R. J. Hamilton of Fulton, O., the company is made up of Cleveland men.

Texas.—The organization of the Aransas Harbor Terminal R. Co. was recently completed in San Antonio when the following officers were elected: W. W. Brooks, Jr., Baltimore, president; C. H. Sawyer vice president and treasurer; T. B. Wheeler, secretary. After the election of officers the contract for the construction of the road was let to Mr. J. P. Nelson, who was present. Mr. Nelson immediately put a force of men at work fixing up a couple of large barges that belong to the company for camping and commissary purposes. Most of the roadbed will be constructed on piling and the work will be pushed to completion as soon as possible. The length of the road will be about ten miles. It extends from this town, which is on the main land, to Harbor Island, and across Harbor Island and Turtle Cave to Mustang Island. About 3½ miles of the roadbed is about ready for the ties and about one mile of the track is laid.

INDUSTRIAL NOTES.

Bridges.

—The Allegheny Valley Railway Company will shortly let the contract for a new bridge to be erected over Little Mahoning creek, to take the place of the wood structure destroyed by fire a short time ago. The new bridge will be of fine steel construction.

—The Penn Bridge Co., of Beaver Falls, has just completed the erection of a bridge at Houston, Texas, which consists of a 180-foot steel span and a 168-foot steel trestle.

—The Wrought Iron Bridge Co., of Canton, O., has been awarded a contract to erect a bridge with steel superstructure and pile substructure at Fairbank, Wyo. The bridge will span the North Platte river and will be 360 feet in length.

—The county commissioners are preparing to issue bonds for \$20,000 for the construction of the new bridge across the Tennessee river near Knoxville.

—The New York & New Jersey Bridge Co. is waiting for action by the sinking fund commission on the question of locating the approach for New York. When it does that there will be no delay with the war department in approving what the sinking fund commission and the state commission have adopted. Responsible bridge builders are ready to make a contract with a guarantee that it will build the structure within five years. It also stands ready to aid in raising money for construction.

—An order has been handed down in the case of the Commonwealth of Pennsylvania vs. The Pittston Ferry Bridge Co., which requires the latter to remove its pier from the Old Ferry and Carbondale road within 90 days. The pier supports in part the elevated approach to the bridge.

—The Norfolk & Western Railroad has a large force of hands at work erecting a new bridge over James river at Natural Bridge station to replace the old bridge, which is too light for the heavy traffic of the line.

—The contract noted in our issue of Jan. 25 as being let to the Lassig Bridge Co., of Chicago, for furnishing the Duluth & Iron Range Railroad, should have read, 218 ore spouts and accessories, plate, girder and lattice span bridges amounting in all to over 600 tons, instead of 226 spouts and 400 tons as noted.

—F. A. Blair of the Davenport and Rock Island Bridge & Terminal Co. has let the contract to M. S. Carter & Co., of St. Louis for the construction of the bridge. It is to be a single-track steel bridge and to be completed by September 1, 1897, operations to commence at once. The contract price is \$400,000.

—There is a possibility of a strike of the bridge and structural iron workers employed on the Northwestern Elevated road structure in Chicago. The Elmira Bridge Co., which has the contract for the iron work, has not yet signed the wage scale presented by the union Jan. 1. At a meeting held last night the men decided to give the company until Feb. 5 to sign the scale. Failing in this, the men will certainly be called out.

—Mr. F. W. Aylmer, Golden, B. C., is preparing plans for the new Kicking Horse bridge. The British Columbia government promised to erect a double track bridge which would accommodate the Canadian Pacific traffic as well as vehicles and foot passengers. This is now thought to be too expensive a bridge for the traffic it would carry, and the present idea is to have a single track bridge which would be wide enough for vehicles, and which would be closed to vehicles when a train was passing over.

—A new bridge scheme at Duluth, Minn., is being projected by the Wisconsin-New Duluth Bridge Co., and is said to be backed by one of the railroads. The proposed location of the bridge is said to be at Spirit Lake on the St. Louis river, 10 miles from the harbor. The company has elected the following officers: George B. Hudnell, president; James Bardon, vice president; John M. McCabe, secretary; John A. Bardon, treasurer.

Buildings.

The Hood Machine Works of Birmingham, Ala., is to erect a new building.

The contract for the erection of the buildings for the new car wheel works lately reported as to be built by N. S. Bouton of Chicago and associates at Birmingham, Ala., has been let to T. C. Thompson & Co.

The Seaboard Air Line and the Western & Atlantic Railroad are reported as about to build a freight depot 800 ft. long at Athens, Ga.

The Plant Railway & Steamship Company's new south Florida shops will be located in High Springs; H. A. Ford, superintendent, Sanford, Fla.

The Baldwin Locomotive Works, Philadelphia, Pa., is building new tank and smith shops 129x177 ft., four stories high, and 49x195 ft., two stories. The smith shop will be of iron construction encased with brick walls. The tank shop will be of iron construction throughout, except the floors and joists and roof, which will be of wood to be encased with brick walls. The first floor will be provided with a 15 ton Sellers electric traveling crane running the entire length of the shop. There will be an elevator of 45,000 lbs. capacity; also a 30 ton double trolley Seller's electric traveling crane over the fourth floor.

The rolling mills of the Peoria Steel & Iron Company, Peoria, Ill., are the subject of negotiation by Youngstown parties.

The building has been completed for the new rod mill of the Illinois Steel Company, at Joliet, and the machinery is now being installed.

Cars.

—Since the H. C. Frick Coke Co. has purchased the McClure Coke Co.'s interests, the Lemont (Pa.) car shops will be moved to Everson, Pa., where the former company has erected new shops. The new shops are well located, commodious, and are turning out a car a day in addition to repairs.

—It is reported that the Quebec Central has ordered 100 new 25 ton box cars.

—The Elliott Car Works, of Gadsden, Ala., manufacturer of railway cars, is now very busily engaged filling the many orders on hand. The company employs 400 men, and has enough work on hand at present to keep the plant in operation for months to come. An order for 150 new cars for the C. R. & C. Railway has just been received.

—The Chicago, Milwaukee & St. Paul Railway will build 20 furniture cars at the West Milwaukee shops.

—The Great Northern is reported to have placed an order with the Barney & Smith Car Co. for 8 sleepers and 4 postal cars.

—Vice President Webb has ordered the Pintsch light put into the cars on the New York & Putnam division of the Central road.

—The Erie management has issued orders that the shops on its lines resume running eight hours per day.

—The Duluth, South Shore & Atlantic Railway has placed its order for 500 gondola cars with the Michigan-Peninsular Car Co.

—The Onio Falls Car Manufacturing Co. has secured the order for 150 box cars from the Cincinnati, New Orleans & Texas Pacific, notice of which has already been made.

—Parties connected with the old Lewis & Fowler Car Co. of Brooklyn (which has for some time been in the hands of a receiver), have organized a new company and are to locate at Elizabethport, N. J. They will engage in the manufacture of tramway, trolley and cable cars, snow

plows and sweepers, and general car supplies, and intend to do a large business. The shops will be started as soon as machinery now being placed in position can be made ready. It is stated that the new works will furnish employment for almost 1,000 men.

Iron and Steel.

—The Latrobe Steel Co., of Philadelphia, has absorbed the plant and business of the Chicago Tire and Spring Co. Mr. C. H. Ferry, president of the Chicago concern, will be made manager of the western plant which will be known as the Melrose Park works, of the Latrobe Steel Co.

—One of the improvements added to the Edgar Thomson Steel works, at Braddock, during the recent suspension is a new finishing mill, containing a full set of hot beds and straightening presses that will permit 65-pound rails being manufactured without extra cost, as heretofore.

—At the annual meeting of the stockholders of the Cambria Iron Co. the following board of directors was elected: Josiah M. Bacon, Robert F. Kennedy, James McMillen, David Reeves, Powell Stackhouse, Edward T. Stotesbury, John W. Townsend, John Lowber Welsh, and R. Francis Wood.

It is announced on good authority that the termination of the receivership of the Pottstown Iron Co. is near at hand. All the creditors have agreed upon a plan of reorganization, and, there being no further obstacle, the great plant will soon resume its wonted popularity.

—In the United States circuit court on Jan. 29 Judge Buffington appointed the Union Trust Co. of Pittsburgh receiver for the Pittsburgh Steel & Iron Manufacturing Co. at the request of the Vega Iron Co. of Duluth. The indebtedness is about \$130,000, with contracts of \$30,000 on hand. The stock on hand is valued at \$70,000. It is thought the receivership will be only temporary, and that by the operation of the plant, which has been idle, the indebtedness will be liquidated in a short time.

Machinery and Tools.

—The Babcock & Wilcox Co., through its Pittsburgh office, George M. Bole, manager, have received an order from the National Galvanizing Co., which is erecting a plant at Bissel, Pa., for three Babcock & Wilcox water tube boilers of 450 horse-power capacity. These will be equipped with Babcock & Wilcox chain grate stokers.

—The Westinghouse Machine Co. expects to be in its new plant at East Pittsburgh within 90 days, where it will have double its present capacity. The company will also manufacture Parson's steam turbine for which it owns the American patents.

—The Pittsburgh Feed Water Heater and Engineering Co. has been awarded a contract for a 125 horse-power feed water heater to Paur Bros. & Co., East End, city.

—Brown & Co., incorporated, operating the Wayne Iron & Steel Works, at Pittsburgh, have received permission from the Secretary of War to erect a coal hoist in the Allegheny river for the purpose of lifting coal out of barges to be used in its plant.

—The additions to the Springfield (O.) Machine Tool Co. are now completed and with the new tools the company has installed, the plant becomes one of the most complete machine tool manufactories in the country. Among the new tools lately purchased are a 48 in. x 48 in. x 24 ft. Gray planer, a 9-ft. improved Bickford radial drill, a No. 5 improved Landis grinder and others including one of the company's own 24 ft. bed 24 in. lathes. The new addition to the shop is 50 ft. wide by 100 ft. in length, with 18 ft. walls and light on three sides. The company also has a foundry and makes castings for a number of the fine machine tool manufacturers of the country. Among orders lately received are six from England covering all lines of the company's machine tools. With one of the most modern and complete plants in the country and an excellent type of tools for its product, the Springfield Machine Tool Co. is making a good record for sales and for satisfactory performance by its tools.

—Messrs. Byram & Co., of Detroit, Mich., are meeting with much success in the sale of their Colliu Cupola Furnace, and have this month received a cable order for the second of these furnaces to be shipped to England.

Miscellaneous.

—The Baldwin Locomotive Works, it is stated, chartered the British steamer Tynehead to carry the second shipment of locomotives built for the Russian government railways. The first shipment, made some weeks ago, embraced 20 passenger engines. The present shipment will contain 20 engines for freight service. The shipment will be landed at Novorossisk, Black Sea. One of these locomotives will be illustrated in our next issue.

—The C. A. C. Tie Plate & Supply Co. of New York City, has been incorporated by Charles W. Dorland, Laurence W. Miller and Joseph F. Darling. The company will manufacture tie plates, railroad supplies, etc.

—The New York office of the Rand Drill Co. will be removed February 1, 1896, to American Surety Building, 100 Broadway, New York City.

—The Buffalo Creek road has given the Brooks Locomotive Works an order for three 20x24 in. six-wheel switching engines.

—Six new locomotives are being constructed at the Juniata shops of the Pennsylvania for the Philadelphia division passenger service.

—The contracts for the regulating works for the Chicago drainage channel has been awarded to Christie & Lowe, of Chicago, Ill., the aggregate of whose prices for all different parts of the work proved to be the lowest. Previous to being awarded the contract the successful bidders agreed to accept still lower prices than those bid for certain parts of the work. The prices now stand as follows: Sluice gates, above elevation, 17.75, \$120,000; masonry below 17.75 \$11 per cu. yd., concrete below 17.75, \$5 per cu. yd.; excavation, 59 cents per cu. yd.; bear trap dam, \$58,000. These regulating works were described in detail in our issue of Nov. 21.

—While operations at Pennsylvania Steel Works are still active there has been falling off lately in output. Last year works were in operation 281 days, employed, on average, 4,600 men and boys to whom was paid a total of

\$1,927,424. Wages past two weeks aggregated \$83,883, which is slightly below the usual average.

—The Bay Terminal road at Toledo, O., is to purchase new rolling stock and motive power, and for this purpose the capital stock of the company has recently been more than doubled. It operates a belt line at Toledo for freight traffic, and is controlled by the Standard Oil Co.]

—The proposed tunnel railway scheme of the New York & Long Island Railway Co. was revived at the last stockholders' meeting, by voting to increase the stock from \$100,000 to \$20,000,000 for this purpose; provided that the consent of the railway commissioners of New York and New Jersey can be obtained. This company proposes to build 26 miles of double track railway, beginning in New Jersey, and to tunnel under the Hudson river, under 42nd street, and under the East river to Long Island. The directors elected were: William Steinway, H. S. Kearney, H. E. Kleber, Louis Von Bernuth, Walter J. Foster, John Bogart, A. G. Mills, W. D. Baldwin, Herbert Steward, Malcolm W. Niven, Edward A. Greene, H. D. Low, all of New York, and A. J. Benedict, of London.

—The Streeter-Ames Weighing & Recording Co. has recently placed three of its weighing and recording machines at Omaha for the use of the Burlington, Northern Pacific, Fremont, Elkhorn & Missouri Valley, Omaha & St. Louis, Missouri Pacific, Northwestern and Rock Island roads, and four at Kansas City for the use of the Kansas City Fort Scott & Memphis, Union Pacific, Santa Fe, Rock Island and Missouri Pacific. These scales were put in in compliance with the new weighing laws of Kansas and Nebraska, which went into effect January 1.

—The new Troy Steel Company has filed at the office of the county clerk in Troy, N. Y., a first mortgage to the New York Guaranty & Indemnity Company for \$1,750,000. The mortgage was executed to raise funds with which to acquire the works, rights and privileges necessary to the business of the new concern. The directors authorized the issuing of 1,750 bonds at \$1,000 each and 100 bonds at \$500 each. Each bond is dated January 1, 1896, and will mature January 1, 1896, at 6 per cent interest. A deed of property has also been filed, whereby Henry H. Rogers, of New York; Junius S. Morgan, of Rye; Smith M. Weed, of Plattsburg; Horace G. Young, of Albany, and Frank S. Witherbee, of Port Henry: the reorganization of the Troy Steel & Iron Company hand over all the property of that concern to the Troy Steel Company.

—The Vulcan Iron Works, Toledo, O., at its annual meeting elected the following officers for the ensuing year: President, A. L. Backus; the president, M. I. Wilcox, and secretary, John W. Smith.

—An official of the Westinghouse Electric & Manufacturing Company, states that the reduction of hours of work to three-quarters time at its East Pittsburgh works, instead of laying off part of its force, is a conservative move adopted by the management in view of the hesitation of trade which has affected the electrical industry as well as the iron and steel lines. The company has several months' orders on hand at the shorter hours, but it is expected that the works will be running full again in a short time. In the meantime extensive changes are being made in the power plant.

—The Connecticut Engineering Company, of Norwich Conn., George W. Phillips, president, closed on Saturday a contract with William C. Clark, of Wakefield, R. I., for the construction of the Sea View Railway, from Watch Hill, through Point Judith and Narragansett Pier, to Wickford; also the Narragansett Electric Railway, from Kingston Junction to Narragansett Pier. The two roads will extend over 40 miles and their completion will cost over \$500,000. This is a very large contract for a company so recently organized. Work will begin early in January and one road at least will be completed by July 1.

—The stockholders of the Columbus & Hocking Coal & Iron Company are resisting the application for a receiver, claiming that it is not necessary to have a receiver where the property is security for three or four times the bonded indebtedness.

—The National Switch & Signal Company has been awarded the contract of installing a 68-lever machine for the Southern Pacific Company near Los Angeles, Cal. Western railroads are evidently beginning to appreciate the value of signaling as this makes the fourth plant ordered from the National by the Southern Pacific in the last two months.

—The Toledo Car Wheel & Foundry Co. of Toledo, O., last week elected the following officers for the ensuing year: President, C. E. Milmine, of New York; secretary and treasurer, H. B. Milmine. Directors: L. S. Baumgardner, W. W. Bolles and A. A. Milmine.

—The Nelson Valve Co. of Elizabeth, N. J., has been organized by Wm. E. Nelson, of Brooklyn; Paul A. Oliver, of Wilkesbarre; Henry B. Bonnell, Elizabeth, and others. The capital stock amounts to \$100,000. A plant will be erected at Brooklyn with a branch factory at Elizabeth.

—A contract for 60,000 ties for the railroad to be constructed by the Kansas City, Pittsburg & Gulf from Beaumont, Tex., to Port Arthur, was placed on the 18th instant with the Reliance, the Texas Tram and the Beaumont Lumber Cos. of Beaumont. The bill aggregates about 2,000,000 ft. The order for ties carries with it a demand for considerable other material.

—The Tennessee Coal, Iron & Railroad Co. has given notice that from January 10 the wages of its 5,000 coal miners will be reduced 5 cents per ton, in accordance with the sliding wage scale contract in effect between the company and its men, whereby 37½ cents is to be paid for each ton of coal mined when iron is \$8.50 or less per ton, and an advance of 2½ cents per ton in wages for each rise of 50 cents per ton in iron prices.

—W. A. Jones of the W. A. Jones Foundry & Machine Co., Chicago, reports that the company's business in power transmission equipment has increased to such an extent that it has been compelled to add to its large plant new floor space 26x75 ft. This has been equipped with machine tools of the latest design for the special work of the company. The establishment is now prepared to furnish estimates on anything that may be required in all the various forms of power transmission outfit.